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THE AMERICAN GAS LIGHT JOURNAL

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BRIEFLY TOLD.

SOMETHING MORE ABOUT THE PEORIA CASE.—In our last issue mention was made of what seemed to us to be an inequitable decision of the Peoria courts in the matter of the valuation of certain property sought to be taken for the uses of the Peoria Terminal Railroad Company from the Peoria Gas Light and Coke Company. To that mention we add the following, for which we are indebted to Mr. Frederic Egner, one of the experts retained by the Gas Company:

ST. LOUIS, MO., Nov. 21st, 1892.

To the Editor of the AMERICAN GAS LIGHT JOURNAL: Although you have undoubtedly been informed of the outcome of the trial at Peoria, I will venture on giving you the facts connected therewith. The Peoria Terminal Railroad Company is the title of a corporation which has been engaged in constructing a railroad on the river front of the city of Peoria. As the title indicates, it is to be a road for the purpose of making money out of any other railroad which may desire to get into Peoria. As the counsel (Judge Evans) of the Peoria Gas Light and Coke Company argued, it was a question—not of taking land from the Gas Company for any public purpose alone, but merely to take land for this Railroad, which, though in one sense a public measure, was nevertheless designed to be operated for the private or common profit of the individuals composing the Railroad Company—but I am getting ahead of my story. This Terminal Company had bought up the right of way all along the river front, paying for the land according to the value which the owners put upon it. As it was considered that the road would benefit the adjoining property, which is used entirely for manufacturing purposes, some of the land was given for merely nominal sums, although other plots were paid for at big prices. On none of this land, however, was there any improvement in the way of buildings, etc. The Terminal people had quietly bought all the land to each side of the gas works, and made their proposition to the Gas Company last of all, expecting to meet with a fair demand for the land they were desirous of obtaining. The Gas Company had made propositions to the Terminal people to the effect that if they could turn over any land, reasonably near to the gas works, equal in area to that sought to be taken, so that the Gas Company could erect thereon a gasholder, the Gas Company would not contest the right of way. The Terminal people were obliged to admit that that was a perfectly fair proposition, but as they knew that no such plot could be secured near the gas works, they proceeded with the condemnation proceedings. The case came on for trial before Judge Shaw, in the Peoria Court, on the 9th of November. During the examination or selection of the jurymen, it seemed to the observer that the Gas Company's case was decided before it was tried, and that nothing that judge, attorneys or witnesses could say would affect the verdict. This, of course, is the writer's opinion; others on the spot did not agree with him. It is not intended to say it was so—it is an opinion—and only an opinion. The Gas Company had invited as expert witnesses Mr. Jos. R. Thomas, Capt. Wm. Henry white, Col. W. A. Stedman, Mr. B. E. Chollar, Mr. Jas. R. Smedberg and the writer. The Railroad Company had retained Mr. Artingstall, Mr. Appleton and Major Randolph, all from Chicago, to prove, as expert civil engineers, facts which the Gas Company did not contest at all, and which, as a matter of fact, did not enter into the ques-

tion of damages, possibly with the sole exception of matter that related to a retaining wall, which the Gas Company's engineers claimed to be necessary, and which the engineers representing the Terminal people were obliged, but not very willingly, to eventually admit was required. These gentlemen were in every way creditable members of the engineering profession, but it was of course not part of their business to prove that the Gas Company would be damaged to any extent, except the simple value of the land. Real estate experts were called on both sides, and it was plainly shown that the land sought to be taken, as it was the entire river front of the gas works, was worth of itself $20,000, while the damage to the Company, through being deprived of this river front, and the further decided cramping of the works for necessary room, was probably equal to $50,000 or $60,000. This was admirably shown by the testimony of Col. Stedman, and fully supported by the opinions of the other expert witnesses. The case was argued at great length for the Terminal people by Messrs. Stevenson & Foster, the Gas Company's case being supported by Messrs. Jack & Tichnor, and Judge Evans. The latter, in the opinion of the writer, contributed the most able and clear statement to the proceedings, and in an eloquent appeal for justice made the matter so plain that even the "intelligent jury" could not have failed to see the point, were it not that the whole thing (as the writer believes) was not decided upon its merits, but by sentiment. The Judge's charge was also exceedingly fair and clear. The verdict rendered was for the sum of $7,300. The case will go up on appeal.

GIVING IT A CERTIFICATE OF CHARACTER.—Elsewhere we note briefly that the Supreme Court of the United States has given an opinion in the case of the Hamilton (O.) Gas Light and Coke Company against the city of Hamilton, in which the complainant prayed that the city be adjudged as having violated law and good faith when it constructed and operated on public account a gas works in opposition to the works of the old Company. The Court upholds the city, and we suppose there is the end of it, although we fail to see the justice of the decision. In the meantime the operators of the Hamilton municipal gas plant have been floundering about hopelessly in their attempts to make gas. They have tried coal gas and failed, and they have tried other gas making processes with a result similar to their ventures in the coal direction. Now, however, they claim to have hit the right thing, and accordingly are out with the following "certificate of character" respecting the virtues of their newest discovery. Even if it does give the Kendall process some "free advertising," we will venture to reproduce the certificate, which we do herewith, with the remark that the Trustees might be better engaged than in the line of advertising anything for anybody. The certificate is appended :

OFFICE OF THE CITY GAS WORKS,
HAMILTON, O., Nov. 19th, 1892.

The undersigned, Trustees of the city gas works, appreciating the need of a more modern system of gas manufacture, were authorized by the City Council to investigate the various systems of making gas, with a view to the adoption by the city of that process which should show the best results in actual practice. The Trustees, after a thorough investigation and inspection of the various oil and water gas systems, unanimously decided to recommend the adoption of the Kendall water oil gas system, as showing the best results and maintaining the highest standard at the least cost of product.

A contract was immediately made by the city of Hamilton, O., with Mr. J. R. Kendall, of Terre Haute, Ind., for the erection of a plant having a daily capacity of 300,000 cubic feet. The plant was completed on the 20th day of October, 1892, and commenced making gas upon that day. The new works have been running for four weeks. The gas produced is a brilliant white light of 22-candle power, burning with a steady, smokeless flame. We have made daily, and almost hourly tests of the gas during this period. We make a thoroughly fixed, noncondensable gas, with either crude oil or gas naphtha. There is no fouling of apparatus and pipes, and, apparently, the repair account of apparatus will be insignificant.

In view of the results, obtained from a new apparatus, we feel confident that future works will be more favorable—certainly cannot be less so—and we cheerfully commend to the gas fraternity of the country Mr. J. R. Kendall and his system of making gas—the one fair and honorable in his dealing, the other brilliant and satisfactory in product. We shall be pleased at all times to show our plant to gas men and others interested in securing good light at comparatively small expense.

(Signed) ROBERT ALLSTATTER, Pres.
JOHN SCHWARZ, } Trustees.
HERMANN REUTTI, }

Attest :
WILLARD SMYERS, Sec'y.
GEO. H. PHILLIPS, Sup't.

[Translated for the JOURNAL by Mr. C. S. Davis.]

Sulphate of Ammonia as a Fertilizer.

[A report presented by Dr. Paul Wagner, of Darmstadt, to the Kiel meeting of the German Association of Gas and Water Engineers.]

I have been honored with the commission to speak to you to-day upon a subject which really appears somewhat incidental and even heterogeneous among the other topics of your to day's programme. But there is no need to enlarge upon the significance which this question of ammoniacal fertilizers has for you, as you have long since discovered for yourselves the importance attaching to it.

For the last four years you have superintended the extensive efforts that have been made to complete an exhaustive research into this subject; and, as a direct result of your labors, the Prussian government has ordered the agricultural experiment stations throughout the kingdom to direct all their energies in this specific direction, and even the German Agricultural Society has at last determined to offer a direct inducement to the comprehensive investigation of the field of ammoniacal fertilizing.

It was your invitation, too, which first led me to dedicate a large part of my spirit of investigation to the question of ammoniacal fertilizers, and I have come to-day to make you my report upon the results of the work which, for four years, I have been carrying on at the instance of the German Agricultural Society. My report shall be very brief. You are not agriculturists. You have only an indirect interest in the ammoniacal fertilizer question. It resolves itself, for you, almost entirely into an inquiry as to what reply may be given to the question :

Is ammoniacal salt a fertilizer whose effectiveness can be relied upon, a fertilizer in which the farmer may place perfect confidence?

And to the further question :

In what ratio of value does ammonium sulphate stand to the nitrogenous fertilizer which at present controls the market, and also to nitric acid nitrate (native carbonate of soda), the so-called Chili saltpeter?

I have labored hard upon the subject of nitrogenous manures for vegetable growth; I have, during the four years just passed, with the help of my assistants, conducted several thousand experiments with manures and plant life, in the light of the questions as to ammoniacal and nitrous fertilizers; and, in a recently published monograph, I have stated in detail my conclusions as drawn from the results of such tests. I appeal to these conclusions, and will, upon these same data, briefly formulate the following theories :

The question in which you are interested may also be stated thus :

Is ammonium salt a fertilizer whose effectiveness can be relied upon in every instance; a fertilizer which the farmer may apply to any sort of soil, and for any sort of vegetable growth, with as confident a degree of certainty in the result as when he uses Chili niter?

This question must, in future, be answered with a decisive "No."

It is Marcker's special privilege to have engaged in numerous experiments in fertilizing, particularly as to the effectiveness of ammoniacal nitrogens in comparison with saltpeter nitrogens; and these experiments have demonstrated how extremely variable are the ammoniacals in their results. Sometimes there resulted an effect in no wise inferior to that produced by a corresponding use of saltpeter; but at other times the results obtained from ammoniums were so inappreciable that one could not but conclude, for certain vegetables—beets, turnips and potatoes—that the ammonium sulphate had been entirely thrown away upon them.

The causes, however, of such wide discrepancies, and of so great unreliability in the results, no one could explain. They were purely conjectural. It was taken for granted—and several appearances contributed to strengthen this belief—that the ammoniacal nitrogens, under certain conditions, might exercise a harmful effect; or that the sulphuric acid, in conjunction with the ammonium, under certain circumstances, worked detrimentally. It was supposed that there must exist in certain plants a marked sensitiveness toward ammoniacal salts; and it was thought possible that in certain soils the transition of the ammonia nitrogens into nitrates—so necessary for the development of the plant nourishing effect of the ammoniacal salts—might proceed too slowly. In short, all sorts of conjectures were hazarded as to the probable causes at the bottom of such startling uncertainty as to the results of fertilizing with ammoniums.

You will readily perceive that under these circumstances the farmers felt little disposition to show a marked preference for sulphate of ammonia; the saltpeter nitrates produced more certain results, and were equally applicable to all sorts of plant culture, for they could be used not only in seeding, but also as a top dressing in April, May or June,

even after drouth, while the price was no higher than that of ammoniacal nitrates. It resulted, as a consequence, that fertilizing ammonium came to be more and more generally abandoned.

From Dr. Warrington's protracted investigations it was found that the effectiveness of ammonium nitrates for barley was only 69 per cent., for potatoes only 47 per cent., and for hay grass only 31 per cent. of that of saltpeter. Dr. Bassler, furthermore, had obtained from the use of 100 kilograms of Chili saltpeter an increased yield of 1,500 kg. of potatoes, while from fertilizing with a corresponding amount of ammonium salts there resulted an increment of but 37 kg. of potatoes. Dr. Samek published his experiments with rutabagas, which showed that, for them, ammonium nitrates had only 16 per cent. of the effectiveness of saltpeter, and so on.

It is clear that under such circumstances sulphate of ammonia was destined to come steadily into worse repute, and I myself, first of all, pointed out to agriculturists in the strongest terms possible the extreme unreliability of ammonium and our scant knowledge of all the most important questions concerning its effectiveness. I felt that I owed it to the farmers to do so. And though I have in consequence repeatedly met with the reproach that I had no more pledged my word to sulphate of ammonia than I had to the "native product," and although those engaged in the ammoniacal industries of England have in particular expressed their opinion of me in no very measured terms, I would repeat to-day exactly what I did then, if I had it to do over again. I regard it as the bounden duty of an investigator to be on the lookout for the existing gaps in knowledge and to warn the erring, as far as in his power lies, against them. Likewise, I further regard it as an inseparable duty of investigators to seek to supply these omissions whenever and wherever discovered. And if I have bestirred myself to fulfil the former duty, I believe that I have been no less zealous in my attempts to carry out the second.

I have kept repeating for the last few years that ammonium salts were not especially reliable in effectiveness; and I have heretofore maintained that the conditions were not sufficiently understood, under which ammonium nitrates were as effectual as saltpeter nitrates, but to-day I am in a position to state, as a conclusion of the investigations which I have subsequently conducted, that sulphate of ammonia may be employed for the purposes of fertilizing with all that degree of reliance which is ordinarily placed in Chili saltpeter. I can state clearly the various causes that are to blame for the unfavorable results obtained hitherto from fertilizing with ammonium; I can likewise give the conditions under which ammonium nitrates may be brought to their competent effectiveness, and under which it works no less surely than does the nitrate of Chili saltpeter.

I will not tire you with the details of my labors and with the various results of my experiments. If you are actively interested you will find them all simply and comprehensively set forth in my work which is to shortly appear uuder the title of "The Nitrogens as Fertilizers for Plant Growth." ("Die Stickstoff dungung der Kulturpflanzen.") I will, in the following sentences, very briefly sum up the principal results of my investigations:

1. I have been unable to verify a single case of an injurious effect resulting to vegetable growth even with unusually large quantities of ammoniacals.

2. The sulphuric acid in sulphate of ammonia, in the quantity of fertilizer ordinarily employed in practice, exerts no deleterious influence upon vegetation.

3. If the nitrogen salts be applied to the plants in such a concentrated solution that an effect injurious to vegetation ensues, such injury will result much sooner from saltpeter fertilizers than from ammoniacal fertilizers.

4. A very considerably smaller effectiveness is produced by ammoniacal nitrogen in comparison with saltpeter nitrogens when the soil shows an insufficiency of carbonate of lime. We found by experiment that for meadow land, which lacked lime, the effectiveness of ammonium was but 28 per cent. of that of saltpeter; while, for exactly similar tests, but with grass land having plenty of lime, it increased up to 90 per cent. of the effectiveness of saltpeter.

5. A decreased effectiveness of ammoniacal in comparison with saltpeter fertilizers is also found when the soil shows an insufficiency of potash. The native carbonate of soda in Chili saltpeter is, under such circumstances, in a position to make up for this lack of potash in the soil, up to a certain point, as it can partially do the work of potash. A use of chloride of sodium, rock salt or nitrate of potash in such cases will increase the efficiency of the ammonium salts.

6. If all the conditions necessary to the greatest resulting efficiency of ammoniacal and saltpeter manures be complied with, the effectiveness of ammonium fertilizers is found to be about 90 per cent. of that of a corresponding quantity of Chili saltpeter.

7. The efficiency of ammoniacal fertilizers surpasses that of saltpeter, when protracted rains and light soil have combined to let the saltpeter fertilizer sink too deeply into the ground.

8. The efficiency of ammoniacal fertilizers surpasses that of saltpeter when the soil has become so rich with niter from heavy and repeated manuring that any further addition of niter, such as would result from the use of saltpeter, would be an injury to it.

9. On an average, the value of ammoniacal fertilizers as manures may well be compared, for ordinary, every day, practical use, with that of the saltpeter fertilizer, always with the understanding that the ammonium salts are to be applied rationally and in a considerate manner; that is, keeping in view all the circumstances of the case.

These are the principal conclusions which I have reached as the fruits of my experiments, and relying upon these conclusions, I can assure you that sulphate of ammonia does most certainly belong to that class of fertilizers which have, when intelligently employed, a perfectly reliable efficiency, and in which the farmer may repose entire confidence. We are now in a position to give the agriculturists the fullest information desired as to what the circumstances are under which ammonium sulphate succeeds in accomplishing its maximum result; we are now in a position to be able to state exactly what measures must be adopted in order to render the efficiency of ammoniacal fertilizers better assured, and we can demonstrate the conditions under which Chili saltpeter is to be given the preference over ammonium and, conversely, when ammonium is to be preferred as a fertilizer to Chili saltpeter.

A great deal has been gained when we have gotten this much, and the task which yet remains to be performed is comparatively an easy one. It is to render the results of our investigations of practical utility, to spread our knowledge to the outermost circle of investigators, to correct current errors, to re establish confidence in the efficacy of ammonium salts and especially to increase the general comprehension of these questions.

With this I will close my report. But, yet, I suppose I should hardly be permitted to end it without having first returned thanks to you, on behalf of all agriculturists, for the stimulus which you gave to the settlement of this vexed subject, resulting in a thorough investigation and a comprehensive understanding of this so much discussed, so much disputed, and withal so important question of fertilizing.

Purification.

[A paper read by Mr. C. C. Carpenter, of Vauxhall, before the Southern District Association of Gas Engineers and Managers, with the discussion thereon.]

The growing importance of the question of efficient and economic purification will not be gainsaid, however much opinions may be divided as to the extent to which, in one particular, this process should be carried. It nevertheless seems not improbable that what are called "London conditions," as affecting the purity of its gas supply, will gradually be extended throughout the kingdom. Signs of this are already apparent, in that some of the largest corporation works which have hitherto enjoyed immunity therefrom are now struggling to master what has been aptly termed the "sulphur difficulty." A discussion of this subject, therefore, by the members of such an Association as this, cannot fail to be productive of good results, in increasing their knowledge of its present theory and practice, as well as by indicating in what direction improvement may be looked for. These considerations are, indeed, the only justification the author can offer in presenting a paper while his investigations were still far from complete.

Purification is generally understood as the process employed for the removal from crude gas of the impurities remaining after it has been properly condensed and washed. These, as is well known, consist mainly of carbon dioxide, sulphureted hydrogen, and carbon disulphide, associated with other compounds of sulphur which are not of great importance. As regards the two former, even in the early days of gas manufacture, when it and chemistry were not allied sciences in the sense they are now becoming, gas managers were fully alive to the disadvantages attending the presence of either in their finished product. With hydrate of lime and oxide of iron their removal could be effected with certainty and ease; and if purification had ceased at this point engineers would have been spared what has since developed into one of their greatest anxieties. But this was not to be; and the name of Dr. Letheby will probably endure among future generations of gas engineers, if for no other reason than as being one of the first to call that attention to

the presence, in purified coal gas, of compounds of sulphur other than sulphureted hydrogen, which resulted in that famous "leap in the dark," as the Gas Referees put it, the embodiment of the sulphur clauses in the Act of 1860. Certainly such a legacy may well be called a vexatious as well as a troublesome one, when it is remembered that, for more than 30 years, engineers and chemists alike have been endeavoring, and still with only incomplete success, to satisfy its conditions. It is, therefore, not to be wondered at that discussions on purification very generally resolve themselves into consideration of the most suitable means for extracting sulphur compounds.

The two methods of using lime for this purpose generally adopted are the rotation system, and what may be called the Beckton system, since it originated in the works of that name. As usually carried out, the latter requires a series of at least eight purifiers worked in the following order: Two containing lime, for the removal of carbon dioxide; two containing oxide of iron, for the removal of sulphureted hydrogen; two containing lime rendered foul by the bye-passing, when necessary, of the two previous boxes; and two catch vessels, for the removal of the remaining sulphureted hydrogen. The carbonic acid vessels are changed as often as may be required to prevent this impurity passing forward into the sulphur boxes. The interposition of the oxide of iron vessels is for the purpose of keeping sulphureted hydrogen out of these also, except when it is desired to make a sulphide, as the operation is called. These oxide vessels serve another purpose—that is, to absorb any oxygen which, as air, may have been drawn in with the crude gas, it being stated that its presence interferes with, or completely upsets the effective working of the sulphur purifiers.

At first sight the system just described appears to be perfection, since each impurity is removed not only by successive steps, but in separate vessels—the carbon dioxide forming innocuous carbonate, and the sulphureted hydrogen held by the two sets of oxide boxes being converted into free sulphur, while the sulphide vessels not only work a great number of months, but it has been proposed to extract the carbon disulphide from their spent material, with what success the author is unaware.

Simple as the process above described appears, yet on a large scale its satisfactory working is attended with difficulty. Not the least serious is the uncertainty of making an effective sulphide vessel, as well as the time occupied in the operation. Provided air be rigidly excluded, the author believes it is not possible to bring this about, under ordinary conditions, by passing into a vessel filled with slaked lime, gas charged with sulphureted hydrogen, but in which no carbon dioxide is present. The lime combines, indeed, with the sulphureted hydrogen, but the resultant compound is quite useless for absorbing carbon disulphide. It is greyish white in color, and is hardly distinguishable in appearance from ordinary slaked lime. It possesses a very strong affinity for oxygen, and the heat evolved by its combination therewith is sufficient to char the wood grids on which it is carried. If, after this heating has taken place, the fouled material is returned to the purifier, it at once absorbs carbon disulphide. Preparing material in this manner is always attended with nuisance, and can only be resorted to in works which are not situate in populous or particular places. In any case, its life and duty are uncertain quantities.

Reverting again to the carbonate vessels, if all trace of carbon dioxide is to be kept out of the sulphide vessels, not two, but probably three or four, would be required, if the lime is to be thoroughly carbonated. As a set-off must, of course, be placed the fact that a larger quantity of sulphur is recoverable from the oxide used. Yet a system possessing the above disadvantages, and requiring at least eight, and perhaps ten purifiers to a set to carry it out, cannot, apart from its uncertainties, be considered an ideal one.

The second method to be dealt with is the rotation system. For this a set of four vessels containing lime, and two oxide of iron, will be sufficient. Though not recommended, a center valve gives all the changes required by the former. This fact is of interest, as probably suggesting how the plan of using lime in this manner came to be tried—namely, by its substitution for oxide in the set of four boxes commonly used in the earlier days of gas lighting. The so called air system of purification consists in using lime vessels in this way, with the addition of a certain percentage of air, drawn in and mixed with the gas by the partial vacuum existing on the retort side of the exhauster. Apart from the smaller number of purifiers required, purification conducted in this manner possesses several important advantages, not the least being the certainty of the process. The sulphur compounds on the outlet of the last vessel do not increase with a sudden jump, but gradually, thus giving ample time for recharging the first vessel with clean lime previous to placing it last in the series, when, if (as should be the case) sulphursted hydrogen is passing into it, the activity of the box begins at once. Another advantage is the synchronizing of the fall in the efficiency of the last vessel for sulphur compounds, with the saturation of the first for carbon dioxide. In other words, the elimination of carbon dioxide may be looked upon as the main duty of lime vessels worked in rotation; the absorption of sulphur compounds and sulphureted hydrogen being a secondary, or rather a parallel reaction.

The question then arises: Can such a system as has been described be carried on with certainty and regularity? The author believes that, under certain conditions, an answer in the affirmative may be given to it. Instead of admitting air in the usual way, the author introduces it into the fourth or third purifier in a rotation set. No oxidizing action therefore takes place antecedent (either in the first purifiers or earlier) to the point where the full effect of it is wanted—namely, in the purifier active for sulphur compounds. Used thus, 1 per cent. of air has been found sufficient to bring about therein the desired reactions regularly and reliably, the scrubber gas containing between 40 and 50 grains of sulphur compounds per 100 cubic feet.

Considerable misapprehension appears to exist as to the basis on which the air should be proportioned. This is quite independent of the quantity of sulphureted hydrogen present, instead of requiring to be varied with it. What is wanted is, not to precipitate as much, but as little sulphur as possible in the lime boxes; all but what is necessary for absorption of carbon disulphide being passed forward into the oxide of iron. The air apparatus required is very simple, consisting of a combined engine and blower and a wet meter. The dial of this should be so arranged that rapid adjustment of quantities passed can be made; and a very good meter for this purpose is manufactured by Messrs. W. and B. Cowan. As an additional refinement, a small box containing slaked lime is added, through which the air is drawn and purified. Daily estimations of the work done by each purifier of the series have been made by the Harcourt color test.

Particulars of Sulphur Purification Experiment.

Coals carbonized	27,747 tons.
Gas made per ton	10,578 cubic feet.
Lime used	924 yards.
Coal carbonized per yard of lime used	30.03 tons.
Sulphur compounds (Referees' test)—	
Summer maximum	12.20 grains.
Winter maximum	13.80 "
Average	9.56 grains per 100 cubic feet.
Superficial area of purifiers per million cubic feet of gas produced per diem—	
Maximum	324 sq. feet.
Minimum	243 "
Mean	302 square feet.

Cycle of Purifiers.

	Order of Working.	CS_2. Grains.	H_2S. Grains.	CO_2. Per Ct.
A	Main inlet	35.7	345	.33
	No. 1 purifier	34.5	345	.23
	No. 2 "	32.3	270	.06
	No. 3 "	3.7	trace	trace
	No. 4 "	3.1	nil	nil
B	Main inlet	35.7	333	.40
	No. 1 purifier	34.3	333	.31
	No. 2 "	34.3	313	.16
	No. 3 "	5.6	7.4	.10
	No. 4 "	2.7	trace	nil
C	Main inlet	38.5	257	.41
	No. 1 purifier	38.5	333	.34
	No. 2 "	34.3	270	.22
	No. 3 "	12.5	161	.13
	No. 4 "	4.4	trace	nil
D	Main inlet	32.3	345	.39
	No. 1 purifier	32.3	357	.37
	No. 2 "	31.3	323	.17
	No. 3 "	20.9	222	trace
	No. 4 "	5.2	27.8	nil
E	Main inlet	34.5	345	.41
	No. 1 purifier	34.3	345	.40
	No. 2 "	33.4	333	.27
	No. 3 "	26.3	274	.05
	No. 4 "	6.3	74	trace
F	Main inlet	34.5	371	.40
	No. 2 purifier	35.7	357	.33
	No. 3 "	31.3	345	.06
	No. 4 "	9.2	151	trace
G	No. 2 "	35.7	—	—
	No. 3 "	33.3	—	—
	No. 4 "	9.5	—	—
	No. 1 "	5.0	nil	—

H	Main inlet	34.5	345		.39
	No. 2 purifier	35.7	345		.36
	No. 3 "	35.7	333		.20
	No. 4 "	16.4	185		.05
	No. 1 "	3.5	trace		nil

NOTE.—Each set of testings gives the average results of the day, except in the case of F and G, which are the figures before and after the change of purifier.

Referring to the second table, under the heading CS_2, the direct reading is in every case given, without adding the 7 or 8 grains stated as necessary to bring the results up to those indicated by the Referees' test. It has been found that, while those figures represent the proper amount when the sulphur impurities are high, they should be reduced by 2 or 3 grains when these are maintained below 10 or 11 grains, as shown by the Referees' test. Attention must also be directed to the testings for CO_2. These percentages are those found with the color test, which, though it does not indicate nearly the total initial quantity, is useful for estimating smaller amounts, and as a delicate test for traces. Tested by means of the Hempel, or, better still, the Orsat apparatus, the carbon dioxide in the scrubbed gas averages about 1.5 per cent.

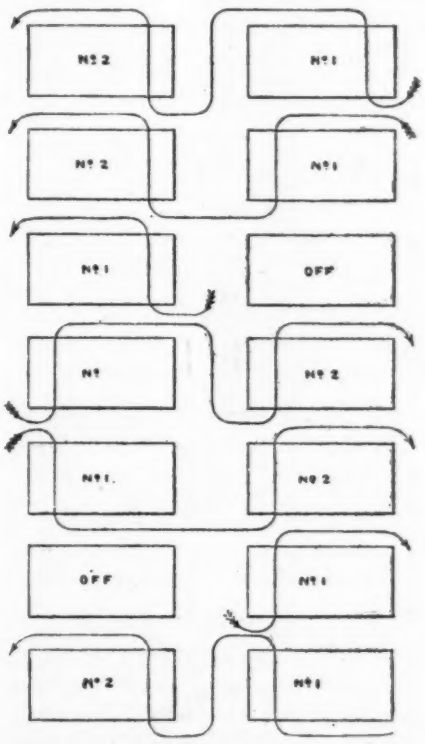
The author cannot refrain from bearing testimony to the ease and accuracy with which the absorbable impurities in crude gas can be rapidly estimated volumetrically with this apparatus—the more so as he does not think its use for the purpose is known to most gas engineers. Great diversity of opinion exists as to the amount of air which may be used for the purpose of purification without detriment to the finished gas. Some experiments have indeed been made to determine the reduction in illuminating power due to mixing gas and air in varying proportions; but, since the oxygen of the latter is absorbed in its passage through the boxes, these experiments are of no use in settling the question.

Dr. Frankland has published the results of his investigations of the effect of nitrogen on the luminosity of ethylene. But these are of little value as evidence of the result of its admixture with coal gas; and as the author was unable to find any references dealing with the matter, he set to work to make experiments with a view to determine the question.

For this purpose gas was stored in a holder 14 ft. 6 in. in diameter, and holding about 2,000 cubic feet—sufficient to secure its constant composition throughout a very large range of experiments. The photometer was a duplex one, made by Messrs. Sugg & Co., its peculiarity consisting in its having two complete sets of apparatus in connection with the bar, the standard burner of which could be instantly supplied from either set. The percentages of nitrogen with which it was desired to experiment were too small to allow of their being measured direct through a meter; and to have made up each sample would have been not only a laborious task, but one attended with unsatisfactory conditions, since considerable time must have elapsed before one experiment could be followed by another. The following arrangement was therefore adopted: A 5 feet standard test holder was partly filled with nitrogen, evolved by gently heating in a water bath a mixture of chromate of potassium, nitrate of ammonia, and nitrite of sodium in solution; the gas being washed and purified. On analysis, it was found to be pure nitrogen. The holder was then lowered until one half cubic foot remained, when its contents were made up to 5 feet by gas from the large store holder. The test holder contained, therefore, a 10 per cent. mixture of nitrogen with the standard gas. Between its outlet and the inlet of one of the photometer meters was fixed an auxiliary clock meter. Through this the nitrogen mixture could be measured in rates giving any desired percentage; and then, mixing with the standard gas on the inlet to one of the photometer meters, passed on to the burner and consumed at the standard 5 feet rate. It was therefore easy to make in rapid succession a series of tests of diluted gas, alternately with standard gas; the same burner and the same standard being used in both cases. Unfortunately, several unlooked-for delays occurred in fitting up the experiment; but most vexatious of all was the discovery of a serious error in the comparison standard, which at the last moment rendered its rejection and the substitution of candles imperative. With these, however, one set of experiments on a 1 per cent. mixture of nitrogen and gas was made; the difference found—burning the gas and the mixture at 5 feet per hour—being 16.2 and 16 candles respectively.

The author greatly regrets that he has been unable to obtain more data on this important subject in time for the present meeting; but he hopes to be able to publish, at no distant date, a full account of the results of his investigations, on the lines laid down. It is also hoped that the importance of this question of nitrogen dilution may be considered to justify the time occupied in its discussion, since it, and it alone, is the determining factor in oxygen versus air. Without laying too much stress upon the preliminary experiment recorded, it may fairly be suggested that it probably explains why some have considered nitrogen as a carrier of hydrocarbons, since it confirms the large-scale experience of its small depreciating effect.

In the foregoing paper purification has been discussed from a chemical rather than an engineering standpoint. To include the latter would make too great demands upon the time at the author's disposal; but he cannot turn from this division of his paper without making reference to one important particular, in which he ventures to think chemical should be considered with engineering requirements. Remembering how largely temperature determines the quality of chemical action, surely it is too much to hope that the complex changes occurring in the purification of coal gas will go on with equal regularity whether the thermometer is below freezing point or some 70° above. The final stage in purification is from the remaining sulphureted hydrogen. In the author's works the average amount of this impurity to be dealt with in the catch vessels is about one-fifth of that present in the scrubbed gas. In this position oxide of iron has hitherto been generally used; and its action is pretty well understood. Some time ago the author devised an arrangement for utilizing, to a further extent than usual, the well-known advantages this material possesses of not giving up any absorbed sulphur when foul gas is passed into it. Two purifiers were used as a set; and they were fitted with valves, so that the direction of the current of gas through each could be reversed at will. Calling these vessels 1 and 2, the cycle of their working is shown in the diagram. The arrangement was of the greatest utility when the number of purifiers was limited.



Instead of oxide of iron, Weldon mud is now coming rapidly to the front; and as it has been used on a large scale at Vauxhall, some particulars of its working may be of interest. The mud is the result of the treatment of chloride of manganese, made as a bye-product in the manufacture of bleaching powder, with lime and air by the Weldon process. Its introduction as a purifying agent has been the result of the united labors of Dr. Hood and Mr. Gordon Salamon. The reaction occurring when sulphureted hydrogen is passed into it, is similar to that with oxide of iron—sulphide of manganese and water being formed; in like manner, when exposed to air, oxidation takes place and sulphur is deposited. The charm of Weldon mud lies in its great affinity for sulphureted hydrogen, which appears to be four or five times greater than that of bog oxide. At Vauxhall, two purifiers 30 feet by 34 feet, each containing 50 tons of mud, have wholly purified from the sulphureted hydrogen, leaving the lime purifiers 400 million feet of gas. The maximum make per day was 6 millions; so that the above result was affected with a purifier area of only 170 superficial feet per million feet of gas. No change has yet been made; and from an inspection of the material, it appears equal to another 400 millions before any is required. The author regrets that he is unable at present to give more complete statis-

tics of its relative efficiency compared with oxide; but he thinks he has said enough to justify his belief that Weldon mud appears likely to largely displace it. Careful trials of the two materials are now being made side by side in two experimental purifiers, each six feet square; and the results will be published in due course.

In conclusion, the author would sum up the chief points he has endeavored to bring out in the foregoing paper as follow:

(1) That of the two methods discussed for dealing with sulphur compounds, the rotation system worked in conjunction with a proper supply of air, is the more reliable and satisfactory.
(2) That this supply of air should be proportioned, having regard to the removal of the carbon disulphide, and *not* the sulphureted hydrogen.
(3) That the reduction in illuminating power due to the presence of nitrogen is expressible in terms of its acting as a diluent only.
(4) That the method of using air proposed by the author, permits its fullest efficiency to be obtained; and that, too, with boxes of relatively small area.
(5) That working with Weldon mud on a large scale shows that the extended use of this material is a matter which may be profitably considered by gas engineers.

Discussion.

The President observed that Mr. Carpenter had treated this old question of purification in a very lucid and exhaustive manner; and he had given to it a freshness that was very welcome. He hoped there would be a good discussion; and that members would freely relate their own experience on this important matter.

Mr. C. Gandon (Lower Sydenham) said the few remarks he should make would simply be for the purpose of opening the discussion, as he had nothing new to say. This subject of sulphur purification was a well worn one. He recollected an esteemed member of the Association on one occasion saying that, if it were not for the wretched sulphur compounds, gas managers would pass a very happy life; and he was inclined to agree with him, for they had given him (Mr. Gandon) a great deal of trouble. Mr. Carpenter, in the commencement of his paper, gave Dr. Letheby the credit of having "invented" these sulphur compounds. He believed this was so—indeed, he had seen a letter written by Dr. Letheby (which was now in the possession of Mr. Magnus Ohren) in which he said that, if he had known the sulphur compounds were going to raise so much trouble among gas makers, he would never have invented them (laughter), and he was sorry he had done so. However, they now understood them better than they did some years ago. With regard to his own works, Mr. Watson knew more about what they were doing in the way of purification than he did himself; and he would be able to give the members some information. He believed they were pretty successful in keeping the sulphur compounds down within limits; but at what cost? He had no hesitation in saying that it was at least 1d. per 1,000 cubic feet on the manufacture of gas. Whether or not "the game was worth the candle" he did not know; but, in his opinion, it was not. He did not believe that any consumer could distinguish between 20 and 30 grains of sulphur per 100 cubic feet. At Sydenham they were now practically purifying with lime. Oxide of iron was out of the question altogether; and they only used it for arresting any fugitive carbureted hydrogen from passing away. They started a pretty theory some years ago, which was to use oxide of iron first to take out the sulphureted hydrogen, then lime to take out the carbonic acid, and then sulphide of calcium was brought to work to take out the sulphur compounds. This, however, would not answer; and the first oxide purifiers had little or nothing to do. He was speaking of his own experience; and he found they must get sulphureted hydrogen into the sulphide of calcium purifiers—the purifiers must contain a certain amount of sulphureted hydrogen in them, in order to get out the sulphur compounds. Mr. Carpenter had suggested a way of doing this; and he appeared to be working very satisfactorily, by the introduction of air, not at the first purifiers, but at the sulphide purifiers. As he (Mr. Gandon) had no experience of this method, he could not, of course, criticize it. There was no doubt, however, that a certain amount of air found its way in whether they wanted it or not; and he believed it had a beneficial effect. He was of opinion that a vast amount of trouble was expended and money wasted on sulphur purification; and although Mr. Carpenter said that, sooner or later, municipalities even would have to bow their heads to the demand for the reduction of the sulphur compounds, for his own part he should be glad if they were allowed free scope in the matter, and not be legally bound to any specified limit. He believed if it were so, gas managers would be better able to deal with the question than they were at present, because they dared not, under the existing restrictions, make experiments to get rid of the sulphur compounds, in case they turned out the wrong way.

Mr. T. May, Jr. (Richmond) remarked that Mr. Carpenter had brought this subject before the members in such a fresh light that he did not think they would be able to adequately discuss it. Air purification to a certain extent was new; but the way in which the author of the paper passed his air in had brought about a different process altogether; and that, in his opinion, was the most interesting part of the paper. A good many of them used air; and, notwithstanding they were told it reduced the illuminating power, they continued to employ it. At Richmond they worked with four vessels; drawing in air at the usual place—at the inlet of the exhauster. A large proportion was used up in the first three vessels of the series in dealing with sulphureted hydrogen; and they got an attenuated quantity in the fourth vessel, which would not be as active as air introduced into the last vessel. He thought they were indebted to Mr. Carpenter for pointing this out so clearly as he had done. As to the experiments with nitrogen, he should look forward with interest to his further investigations; and he might perhaps give the members the results in his address in February. He understood that Mr. Carpenter found 1 per cent. mixture of nitrogen only reduced the illuminating power 0.2 candle. Well, this was very much less than it would work out if they simply took the nitrogen as a diluent. He believed, with regard to this question of illuminating power, that most of them had been inclined to overlook the fact that their purifiers reached a very much higher temperature when using air. In his own case, the temperature was 15 per cent. higher with air than when it was shut off. The temperature had a great deal to do with the illuminating power. In winter, when the temperature had been low, they had had difficulty—using the same coal and working under the ordinary conditions—to obtain gas of the necessary illuminating power. As to Weldon mud, he observed that Mr. Carpenter had purified a large quantity of gas in the two purifiers; and he should like to know whether his experience had been that, as it absorbed such a large quantity of sulphur, it was inclined to throw back pressure. His own experience of oxide purifiers was that they had to be changed on account of back pressure, and not through being fouled.

Mr. J. C. Watson (Lower Sydenham) did not think that he could say much on this question. The author of the paper had carried out practically the same system of purification as they had at Sydenham; but, instead of having four boxes, they used a greater number. They had six lime purifiers in each series; and by the method of rotation, the lime was fairly carbonated before it was changed. After the carbonic acid purifiers came two sulphide boxes. With regard to the question of excessive quantities of sulphur, this arose from one of two causes—one was an excess of sulphureted hydrogen going into the sulphide box, or an excess of carbonic acid. If one could get down the excess of sulphureted hydrogen through the carbonic acid boxes, they could make the life of the sulphide boxes practically about six months; but if they had an excess of sulphureted hydrogen or of carbonic acid, they found the sulphide boxes did not last so long. He should estimate that the amount of air going into their purifiers was about 1.5 per cent.

Mr. Frank Livesey (London) said, in criticizing the paper, the first thing that struck him was the relative merits of the two systems of purification—the rotation, and that which had different boxes for different impurities. He had not had much experience with the Beckton system, as Mr. Carpenter had designated it; but he had had a little, and it was in this way: The usual carbonic acid boxes, then sulphide boxes, and catch boxes at the last. This was tried at the Greenwich station of the South Metropolitan Gas Company; and it was on the anti-dip system, so that no air was drawn into the gas. The sulphide boxes always had to be "made." The lime had to be taken out and left a few hours; and he thought it was watered well until it heated. It was then put back again, and was in a condition to take out the sulphur compounds. He considered the system was very unsatisfactory; and as it ranged the highest in point of cost for purification in all the six works of the Company, they decided to give it up, and try the rotation system. The purifiers were therefore altered; and the rotation system was tried. However, it did not answer until air was pumped in; and, of course, in that case it must be pumped in, as there was no vacuum at all. It was now giving very good results indeed. He could not quite agree with Mr. Watson that he was working on the same lines as Mr. Carpenter; it seemed to him that he was working altogether differently. The element of success of the rotation system was this—that, supposing they had four boxes, they must have the sulphureted hydrogen ahead of the carbonic acid; that was to say, supposing they had the carbonic acid passing through the first and second purifiers, then they ought to have the sulphureted hydrogen slowly passing through the third. If they

had these conditions, and a certain amount of air was going in, the sulphur compounds could be reduced to any desired extent. But if the carbonic acid ran neck and neck with the sulphureted hydrogen—the two going on together—they must sulphide the boxes before the carbonic oxide was allowed to go in. A little carbonic acid with the rotation system did no harm if they had plenty of sulphureted hydrogen. He thought Mr. Carpenter's system of admitting air the right one; and he could not see the use of letting air in the lime boxes when they were carbonated. At one of their works, whenever they had a low temperature, the purifiers got out of order almost directly. About a fortnight ago, they had a case like this; and then the only thing they could do was to take the lime out, heat it, and then put it back again, when it did its work. If they took a portion of lime and put pure sulphureted hyprogen into it, it would be found that, if they tried to take out sulphur by its means, it would not be successful. He had tried it experimentally; and it reduced the sulphur very slightly indeed, and made the material a dark green color. With regard to Weldon mud, Mr. Carpenter said he had considered its efficiency as a purifier; then he (Mr. Livesey) must protest against its price. This was a very great element in the success of Weldon mud. There was a heavy royalty upon it—the charge being from £4 to £5 per ton—and it would have to do a great deal more than oxide before it was much used. They were greatly indebted to the author of the paper; for, although in the past they had been purifying somewhat successfully, they did not really thoroughly understand the matter, and, in his opinion, Mr. Carpenter was working in the right direction.

Mr. J. W. Helps (Croydon) said that Mr. Livesey had remarked upon Mr. Watson's expression of opinion that the system carried on at Sydenham was something like that described by Mr. Carpenter; and he (Mr. Helps) would go so far as to say that the system on which they worked at Croydon was very much the same as that described by Mr. Watson. They purified practically by lime alone. Until the present season, they had only four boxes, giving an average of 250 superficial feet per million cubic feet of gas. They had now four boxes of lime, two of which were put in and allowed to foul and form sulphide, and finally two boxes of oxide. He would go so far as to say that during two years (using about 1½ per cent. of air), they had no difficulty whatever in keeping the sulphur compounds well below 15 grains. There was one thing he ought perhaps to mention. They used at Croydon one kind of coal only; but during the recent Durham strike, they had to employ such material as they could obtain. They then experienced some difficulty, as they were not used to having such a large amount of sulphur to deal with as found its way into the purifiers. But, even then, he was pleased to say, they did not get more than 15 grains. In connection with the 1½ per cent. of air he had mentioned, there was one point that did not appear to have been alluded to in the course of the discussion on the question of the rise in temperature. In their case they found a considerable rise, even higher than the 15° referred to by Mr. May; it was sometimes quite 30°. When he first started the air process, they had a great increase in the amount of naphthaline deposit on the works. It seemed to him that this rise of temperature would keep a large amount of moisture in suspension in the gas; and did it not also deposit naphthaline? At Croydon, they put the air in the first box. They employed one of Cowan's air meters; and passed the air in at the back of the exhauster. Speaking of the results the author had obtained, it appeared that he purified 30 tons of coal with a yard of lime; while, putting in the air as they did at Croydon, they did practically the same amount of work. This being so, though he was fain to acknowledge that Mr. Carpenter's system theoretically was the correct one, he did not quite see where the advantage came in. It seemed to him that the important secrets of purification were: First, to have plenty of area; secondly, to use a certain amount of air; and, thirdly, to use the lime in as heavy layers as possible, and properly slake it—that was, have plenty of water in it. He agreed with Mr. Livesey, and it might be seen from everyday experience, that the sulphureted hydrogen should be in advance of the carbonic acid.

Mr. A. F. Browne (Rotherhithe) said that since he had been in charge of the Rotherhithe station of the South Metropolitan Gas Company, they had worked by rotation four lime purifiers, followed by three oxide catch vessels. His experience had been precisely similar to Mr. Gandon's. During the past ten years they had purified with lime only, the oxide purifiers having been scarcely in work, for the simple reason that no sulphureted hydrogen had got past the last lime box into them. It had been only on comparatively rare occasions that this had been the case. During the past decade at Rotherhithe they had gone on purifying the gas from the sulphur compounds without any difficulty whatever, with the exception of one or two instances. On one occasion there was a rise in the sulphur compounds, which was due to bringing into action some boxes of which the connections had been altered, and the set had been recharged with clean lime throughout. When these purifiers were put to work in conjunction with the other set, which were under normal conditions, the sulphur rose. They got over this in a few days; but in the past summer they had had a little further trouble. During this time he was at his wits' end to know how to get over the difficulty. Mr. Carpenter called at Rotherhithe, and, in the course of conversation on the subject, he said: "Your four boxes seem to do each of them a little; but not one of them appears to do too much." That was true with the rotation system, as worked at the Rotherhithe station. He noticed the great difference between Mr. Carpenter's plan and his own, that the bulk of the work was done in one of the boxes. In this way it seemed to him (Mr. Browne) that Mr. Carpenter was able to get his first and his second box more thoroughly carbonated than if he worked as they did at Rotherhithe. He had not been in the habit of introducing air into the boxes at all; and their system of purification had been very expensive. As a rule, the quantity of coal purified per yard of lime had not exceeded 24 tons; while Mr. Carpenter had purified 30 tons. He should like to point out, however, that this 30 tons was not an exceedingly favorable result. At the Old Kent Road works, he happened to know that the average was at least that, and sometimes more. He believed in some half years they had purified as much as 38 tons. At Mr. Braidwood's works, at Greenwich, 34 tons of coal were purified by a yard of lime; but he knew that Mr. Braidwood used a certain measured quantity of air. Mr. Livesey informed him that, at the Old Kent Road works, they were in the habit of regularly passing in air. Therefore he did not quite see that the introduction of the air to the third and fourth boxes resulted in any great saving of lime, if these experiments were a fair criterion; but, on the other hand, Mr. Carpenter did appear to be able to master the sulphureted hydrogen boxes with great certainty. There was another way in which it seemed to him a saving might be effected by employing the air as Mr. Carpenter did; and that was he appeared to pass over into his oxide boxes a certain amount of sulphureted hydrogen which was ultimately recoverable. He should be glad if Mr. Carpenter would clearly explain his views as to the saving realized by this process. With regard to the sulphureted hydrogen and carbonic acid being in rotation, he agreed that, in order to be safe, the sulphureted hydrogen should be at least one box in advance of the carbonic acid. That was the trouble he had to contend with last summer. Somehow or other, the relative positions of these impurities became altered—the carbonic acid caught up to the sulphureted hydrogen, and then they could not deal at all with the impurities.

Mr. S. W. Durkin (Southampton) said he did not know that he could throw any new light upon the subject of purification, but he should like to record his experience with regard to air purification. He had now had it under way for the past two years, and he had no desire at present to discard it, unless he could find something better to take its place. Mr. Carpenter's idea was rather a step in advance. At Southampton they measured the air in on the inlet side of the exhauster—sometimes going as high as 3 per cent. and at other times rather less. As far as the quantity of air was concerned, it did not appear to have had any material effect on the illuminating power. He worked on the rotation system; and he had six lime boxes now in use, and three oxide. He found, by closely watching and testing every day, that they could run the first lime box until it was fairly well carbonated. The upper tier certainly did not come off quite so grey as the lower ones; but this arose, he thought, from the fact that it got more moist from the condensation that took place during the passage of the gas, The lower tiers came out perfectly dry; and the moisture appeared to be driven ahead of the stream of gas, and condensed into the bottoms of the oxide boxes. Although they were not working under the sulphur clauses, he thought it was best to take out the sulphur compounds as far as possible. On the whole, since the introduction of air commenced, the cost of purification had been very much less than it was previously. Many years ago, in the good old days, lime was used entirely for purifying purposes; then the day came when oxide of iron superseded it. He was very much surprised on one occasion by a gentleman asking him to look into his office, as he had something curious to show him. He went, and found that he had an ordinary gas stove in use burning illuminating gas. It had an iron pipe leading away into the flue, and at the overlapping junctions of this pipe there were streaks of a yellowish-looking salt down the outside. Of course, he professed ignorance as to the cause; but he suspected what it was, and afterwards found that this yellowish powder contained a large percentage of sulphur. Testing by Letheby's system, he discovered that the sulphur compounds in the gas then amounted to something like 40 to 55 grains per 100 cubic feet. A great deal had

been said with regard to the expense of removing sulphur compounds; but he knew that, at the time he referred to, they gave off very unpleasant odors in rooms lighted by the gas. There was one other point—the effect of temperature. He had noticed that, when the temperature was falling, the lime boxes were not so effective as when at an average temperature. To overcome this in his own case, he slipped the gas by the condenser, and so kept up the temperature of the purifiers.

Mr. H. Smythe (Maidstone) remarked that about twelve years ago his Company came under the sulphur clauses; and during that time he had been working in different ways. Two years since he was working on the rotation system; and by this means he was able to keep the sulphur within the limits, as shown by the tests made practically everyday by the County Analyst of Kent. The figure was from 10 to 15 grains per 100 cubic feet. Two years ago his Directors thought they would like the sulphur kept under 10 grains. Of course, he did not like this; but he set to work, and was glad to say that he had been able to comply with their wishes. He simply effected the purification by four lime boxes—using the lime in layers of 9, 8, and 7 inches, and admitting about 1½ per cent. of air. He believed in reducing the sulphur compounds to the lowest point.

Mr. J. Tysoe (East Greenwich) observed that the author of the paper had stated that what was wanted was as little sulphur as possible in the lime boxes, and that it should be passed forward into the oxide of iron. He (the speaker) found that they could not get the sulphureted hydrogen sufficiently forward to go into the oxide boxes. He tried to thoroughly carbonate the first lime box, and when this was done he found they were doing the best work with the lime. The only thing that would push forward the sulphureted hydrogen was the carbonic acid; and he should like a little information as to how Mr. Carpenter could regulate this. If it was necessary to get it forward, how could it be managed?

The President remarked that, before calling upon the author to reply, he should like to state the method in use at his own works, which might also be called the rotation system. They had six purifiers, four of which were filled with lime, and worked in rotation, and then two filled with oxide to act as catch boxes. With crude gas, containing, at the inlet of the purifiers, something over 30 grains of sulphur compounds, they had no difficulty in reducing it to 10 grains, and it was scarcely ever above this figure. He thought this rotation system was more simple than any other arrangement in use; and, as far as he could see, it was quite as economical. Before leaving home that moring he calculated the quantity of lime used per million cubic feet; and it worked out to about 2½ yards, which was equal to 37 tons of coal per yard of lime. Something had been said as to the desirability of removing the sulphur compounds, and of that he had no doubt whatever in his own mind. If the proper ventilation of rooms could be insured, there would be no need to devote so much time to sulphur compounds, or to spend such a large amount of money in trying to remove them. They had little control over this question of ventilation; and they must make the best of things as they found them, and endeavor to send out the gas as pure as possible. He thought Mr. Carpenter had helped the members a good deal by showing them the proper way to use air.

Mr. Carpenter, in replying to the discussion, said he was much obliged to the members for the care and very evident attention they had given to the paper. There was one point in reference to the amount of coal purified per yard of lime. At the Vauxhall gas works, his station meters were rather more than half a mile from the works; and they were arranged in this way: He had two sets of lime purifiers, and there were mains which ran down to Kennington Lane where the meters were situated. While engaged on the experiments alluded to in the paper, he thought it highly desirable to work with one set of purifiers instead of two; so that, if the sulphur compounds went up, he would not open another stream, but would keep them down with one set only. Besides he had no means of measuring the amount of gas that passed through either stream. The two streams of gas were measured together; but the whole of the experiments had been made with one set of lime purifiers. As to "the superficial area of the purifiers per million cubic feet of gas produced," it would be seen from the table that the maximum area of the boxes throughout the experiments had been 324 superficial feet per million cubic feet of gas; the minimum, 243 feet; and the mean, 302 feet. He believed Mr. Newbigging had said that 600 feet were required; and Mr. Frank Livesey had placed the figure at 500 feet. Therefore, he had been working with a very limited purifying area. This was one reason why the amount of work done by the lime was not its maximum. At the beginning of the experiments, when they were working with the purifying area equal to 324 feet per million cubic feet of gas, they were using less lime than at the close of the experiment with 243 feet only. On two occasions during last summer, the maximum reached was 12.2 grains; so that when they looked at the question of the amount of lime used, they must bear in mind the lowness of the sulphur compounds and their regularity, and the small purifying area they had to work with. The President and most of the speakers had urged how important it was to have a large purifying area; and he felt pretty sure that some of the members had several times more than he had to deal with in the course of these experiments. He remembered one case in which the results of some experiments were given; and there they had no less than twenty times the area of purifier capacity he possessed at Vauxhall. Mr. Tysoe had spoken about the amount of sulphur precipitated in the vessels. They could get rid of the sulphureted hydrogen in either of two ways—(1) by absorbing it in the lime vessels, or (2) it could be precipitated as free sulphur. But they did not want to precipitate it as free sulphur, because at present it was not recoverable in this form from spent lime; and they would be using up both their air and sulphureted hydrogen in the wrong place. Mr. Durkin's experiences were very interesting to him—especially on the question of temperature. He believed he had delicately hinted in the paper that there were some reasons in favor of placing the purifiers in a purifying house rather than have them situated in the open air. They could not expect this complex action to go on with a temperature varying from zero to above 100° in the summer time. They took a great deal of care to maintain the temperature of the vessels at Vauxhall. They did not "slip by" the condensers in the way referred to by Mr. Durkin; but, by means of steam, they kept the temperature of the gas, leaving the washers at from 70° to 90° throughout the year. They never let the temperature go lower; and he thought further investigations would prove that more attention should be given to the effect of temperature. Mr. Durkin stated that he was able to use 3 per cent. of air without finding any ill effect as regarded the illuminating power. He (Mr. Carpenter) thought that, if they used air at all, and so had nitrogen in the gas, there must be some reduction of illuminating power. With regard to Weldon mud, as Mr. May had pointed out, when oxide of iron was used for a long time—that was, until it was saturated with sulphur—there was so much back pressure that the boxes had to be cleared. Now he (Mr. Carpenter) thought this was rather a good thing, and for this reason: One drawback (and he thought the only drawback) in the use of this mud was that, instead of the pressure increasing as the mud became saturated, it decreased. Consequently, great care was requisite in putting the material in the purifiers—in having it laid perfectly even over the whole area—as where the gas passed through and sulphided the material, the area of passage was increased; that was to say, as the material got foul, the gas would go through more easily. The pressure given by the Weldon mud was reduced very considerably as its saturation increased. Mr. Watson and one or two other gentlemen said that their purification was practically all done by lime. Well, that was, of course, a distinct point of difference between their working and what he (Mr. Carpenter) had been doing. If they put the air in at the right place, they would naturally see that the sulphureted hydrogen was necessary in order to get rid of the sulphur compounds, and the other went forward into the catch vessel where it would be of use. He ought to have mentioned that Weldon mud in the condition in which it was first placed in the boxes gave much less pressure than oxide of iron. Oxide, so far as his experience went, in order to work it in boxes of small area, required to be wet, or put in thin layers. They were able to pass 6,000,000 cubic feet of gas through a box area of 1,020 square feet, with a pressure of about 2½ or 3 inches, which was very low. With regard to the question of taking out the sulphur compounds, the fact that it was a difficult process was not in itself a reason why they should not be taken out. Mr. Gandon had had a long experience in the removal of sulphur compounds—in fact, the difficulties under which he labored some years ago had the attention of skilled chemists. But for a long time little success followed their investigations, and therefore one could not wonder that gas managers looked upon it as a very troublesome matter to take the sulphur compounds out. However, the sulphur compounds were only a small percentage, compared with the carbon dioxide; and he thought it went without saying that, if they could run the sulphur purification parallel with the carbonic acid purification, they would find the cost was not so great as it appeared to be. It was not fair to attach the whole of the cost of the lime to sulphur purification, a large proportion of it being due to the extraction of carbon dioxide.

Mr. W. D. Child (Romford) moved a vote of thanks to Mr. Carpenter for his instructive paper. The subject he had dealt with was one of the greatest value to everyone connected with the management of gas works, even if, like himself, they were not burdened with the necessity of removing the sulphur compounds. He thought that, whether or not

it was a matter of necessity, they ought to remove them, in order to add to the comfort of the consumers. He ventured to hope that Mr. Carpenter's year of office would be as instructive to himself as it bid fair to be to the members. [Adopted.]

The Collins Oil Spraying Device

On November 1st U. S. Letters Patent (No. 485,257) were granted to Mr. Charles R. Collins, of Philadelphia (subsequently the inventor assigned the rights to the United Gas Improvement Company), for "improvements in oil spraying or atomizing devices for gas apparatus." Using the words of the specification, Mr. Collins notes that the invention relates, in general, to apparatus for the production of carbureted water gas, and it relates more particularly to certain improvements in the device for injecting oil or other liquid hydrocarbons into the water gas.

The principal objects of my present invention are, first, to obviate waste of the liquid hydrocarbon and to hasten, facilitate, and finally attain a more perfect carburation of the water gas than has hitherto been possible; second, to provide a simple, durable, efficient and comparatively inexpensive device for economically injecting liquid hydrocarbons into a supply of water gas in such manner that the same is thoroughly and completely carbureted; third, to so construct and arrange the various parts of the device as that the same may be readily detached and cleaned or repaired and subsequently assembled for use; and fourth, to provide means for adjusting the operative parts of the device in order to compensate for expansion, contraction and wear of the parts thereof.

Fig. 1.

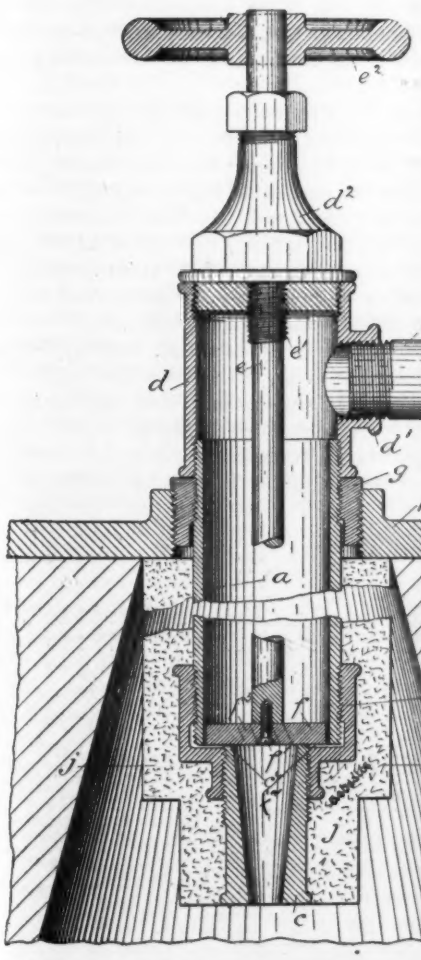


Fig. 2.

Fig. 3

My invention, stated in general terms, consists of an oil spraying or atomizing device for gas apparatus comprising a sectional casing, a diaphragm provided with inclined apertures for imparting rotary motion to the jets or streams of liquid hydrocarbon as they are discharged from the casing, and means for adjustably seating said diaphragm, and my invention further consists of the improvements hereinafter described and claimed.

The nature, objects and scope of my invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, and in which—

Figure 1 is a view, partly in side elevation and partly in central section, of an oil spraying or atomizing device embodying features of my invention in application to the wall of a chamber in a gas apparatus. Fig. 2 is a top or plan view, drawn to an enlarged scale, of the diaphragm illustrated in Fig. 1, showing inclined apertures therein for imparting rotary motion to the escaping jets or streams of liquid hydrocarbons, and Fig. 3 is a section taken on the line 3 3 of Fig. 2.

Referring to the drawings, the main casing of the oil spraying or atomizing device comprises a tube a, externally threaded at the respective extremities thereof, a nipple b, mounted upon one extremity of the tube a, a nozzle c, inserted into the nipple b, and an internally-threaded thimble d, mounted upon the other extremity of the tube a, and provided with a T-union d^1, and with a detachable stuffing box d^2.

e is a spindle provided with an exterior thread e^1, engaging a thread cut or otherwise formed upon the internal wall of the stuffing-box d^2, and with a handwheel e^2, accessible from the outside of the main casing, in order that the spindle e may be shifted backward and forward or upward or downward in the main casing of the device by the simple operation of turning the handwheel e^2 in one direction or the other, as required.

f is a diaphragm detachably connected with the spindle e by means of a screw f^1, and adapted to be firmly seated upon the internal edge c^1 of the nozzle c, that is for this purpose permitted to extend through the nipple c, as shown in Fig. 1.

f^3 are inclined apertures drilled or otherwise formed in the diaphragm f. The number and relative dispositions of these apertures f^3 may be varied and the inclination thereof may be increased or diminished, the object being to cause a rotary motion to be imparted to the jets or streams of liquid hydrocarbon as they are discharged through the nozzle c.

g is a bushing mounted upon the exterior of the casing of the device and adapted to afford means whereby the same may be conveniently secured to place.

In use the T-union d^1 is connected with a pipe d^2, communicating with a suitable supply of liquid hydrocarbon (not shown), and the bushing g is screwed or otherwise inserted into a suitable aperture h, formed in one of the walls i of a chamber to which water gas is supplied and in which it is carbureted, and a covering of asbestos or analogous substance or material j is preferably applied to the external portions of the casing subjected to the heat of the gas.

The mode of operation of the herein above described oil spraying or atomizing device is as follows: Oil or other liquid hydrocarbon under pressure enters the main casing through the T-union d^3, and after passing through the perforated diaphragm f, escapes through the nozzle c into the carbureting or other chamber. In its passage through the perforations f^3 of the diaphragm f the supply of oil is broken up into jets or streams and the inclination of the perforations f^3 causes a rotary motion to be imparted to the jets or streams as they issue from the nozzle c. This rotary or spiral motion of the issuing jets or streams is important, because it insures the thorough carburation of the gas and prevents the disposition of liquid hydrocarbon upon the walls of the carbureting or other chamber. By these means the quality of the carbureted gas is improved and a material economy in liquid hydrocarbon is effected. The exterior casing is exposed to a considerable degree of heat, and consequently expands and contracts. However, the diaphragm f may be constantly maintained firmly to place in contact with its seat f^2 by means of the handwheel e^2 and spindle e, so that leakage of the liquid hydrocarbon around the diaphragm f is completely obviated. Inasmuch as the respective parts of the spraying or atomizing device are all detachable, it follows that they may readily be removed and repaired or cleaned and that the diaphragm f may be detached and replaced by another diaphragm having a greater or less number of apertures disposed at a greater or less inclination, as may be required.

The Cost of Electric Lighting in England.

The following interesting editorial reference to the above subject is from a recent issue of *Engineering:*

The St. Pancras Vestry have drawn public attention to the fact that the cost of electric supply is greatly increased by the short period during which the machinery is fully employed in each day. A glance at the load diagram of a representative London station shows that the maximum demand only lasts for a very few minutes. The load diagram runs up into a sharp peak, and as soon as it has reached the apex it commences to decline. Even if we take the curve for the darkest part of the year (omitting fogs) and flatten off the summit, the period of maximum lighting only extends over 3½ hours. During the rest of the day and night a very large proportion of the machinery is doing nothing,

while several of the boilers are lying with banked fires. Nevertheless, constant supervision must be maintained, and a full staff of men must be within call in case of fogs or other cause of sudden demand. Hence it comes that the consumer must pay a price for his current vastly greater than if it were capable of being manufactured at a uniform rate over the 24 hours and stored for use as wanted. To bring about a more even demand by increasing the use of current during the daylight hours, the Vestry of St. Pancras is prepared to supply selected customers at half price—6 cents per unit instead of 12 cents—during the time that artificial light is not in great demand. An ingenious method has been devised by their managing engineer, Mr. Baron, whereby the circuits in an establishment are combined with two meters, and so arranged that when the general lighting circuit is in operation all the current must pass through one meter, but when power only is required, with or without a few lamps in specially dark places, the current can be switched through a second meter. The ideal system would be to stop the use of current for power purposes as soon as general lighting commenced, as that would fill up the valleys in the diagram without increasing the height of the peaks. This is manifestly impossible, but the doubling of the cost after dark will, no doubt, exercise a very noticeable effect on the demand. Electric motors are only used in London in light trades where the demand is not constant, and it will often be quite feasible to restrict their use to the hours of daylight. With energy delivered at the rate of 4½ cents per horse power hour, the use of motors may be expected to increase.

In some other towns a proposal has been made to give a rebate on the consumer's quarterly bills varying with the percentage used of the maximum current demanded. The object of this is to limit the possible demand that has to be met, to something more nearly approaching the average demand than is now the case. Probably this is an unnecessary complication, for experience will soon show what proportion the output of the station should bear to the number of lamps installed. Even if a mistake be made in the first instance, and too much machinery laid down, the growing nature of the demand will soon rectify it. Electric light plants are usually installed in a tentative fashion. Their pressing requirement is work during daylight hours. To show how costly is their idleness, Dr. John Hopkinson took this matter as the subject of a presidential address he delivered a few days ago to the Junior Engineering Society. He imagined a station capable of supplying 40,000 16-candle power lamps at the same time, and worked out the annual charges first, on the hypothesis that the station shall always be ready to supply the 40,000 lights at half an hour's notice, day or night, but that the lights were hardly ever actually required; secondly, on the hypothesis that the 40,000 lamps were steadily and continuously supplied day and night. In the former case the revenue is *nil*, and the disbursement all pure loss. In the latter case the revenue, at 16 cents per unit, is $3,650,000 a year. The capital outlay he put down at $725,000, or about $18.12 a lamp, including land and buildings, or $13.12 a lamp, without land and buildings. The following table gives the fixed charges arranged in two columns, for two conditions of working. Dr. Hopkinson took the coal at 3 lbs. per unit (2¼ lbs. per horse power hour) for full and continuous working, and 14 lb. per day per unit per hour that the plant was capable of producing, for the idle working. In the former case 30,000 tons per year would be required, and in the latter case 6,000 tons. Taking the stoves at $3,000 and $15,000 in the two cases, and the labor at $25,000 and $17,500, we get

	Running Light.	Fully Loaded.
Land—4 per cent. interest	$5,000	$5,000
Bulidings, 10 per cent. interest and depreciation	7,500	7,500
Rates	2,500	2,500
Boilers—4 per cent. interest, 3 per cent. amortisation, 8 per cent. repairs, etc	10,500	10,500
Switchboards and conductors, interest and depreciation, 15 per cent.	39,000	39,000
Engines—light, 9 per cent.; loaded, 15 per cent.	10,800	18,000
Dynamos	6,750	11,250
	$82,050	$93,750

	Running Light.	Fully Loaded.
Fixed charges	$82,050	$93,750
Coal at $5	30,000	150,000
Stores	3,000	15,000
Wages	25,000	37,500
	$140,050	$296,250

In the case of running fully loaded the cost comes out at $1.32 per unit, while with no load the cost per unit is practically infinite. Of course this includes nothing for directors' fees, cost of collecting accounts, etc., and only 4 per cent. for interest on capital outlays. But even if a liberal addition be made for these it will be seen that electric light is enormously cheaper than gas under a uniform demand.

Yet the consumer who has dark offices, and keeps his lamps alight for eight hours every day, pays an equal rate per unit with the man who runs the light for an hour or two occasionally. Looking back to the estimate of cost, it will be seen that a customer demanding the right to use current up to the extent of one unit per hour—that is, enough to keep sixteen lamps burning—involves the undertakers, under the conditions set forth, in an annual charge of $55 if he never lights his lamps, while if he burns them all the year unceasingly it costs them $120. Now in London the average annual charge per 16 candle power lamp secured by the companies is about $5, so that they receive $80 for a customer with sixteen lamps. Of course they have expenses beyond those in the estimate above, and expect to pay more than 4 per cent.; on the other hand they calculate that the customers will never all be burning their lamps at the same time, and thus economize in their plant.

Dr. Hopkinson has made an official suggestion to the Board of Trade in certain cases that "for each unit per hour in the maximum power demanded, a charge not exceeding $15 per quarter, and in addition for each unit supplied, a charge not exceeding 4 cents." He would give the customers the choice of this method of paying, and the usual one of 14 cents and 16 cents per unit, in order to encourage them not to instal unnecessary lamps, and to use those that they have freely and liberally Under this plan the man with sixteen lamps would pay $60 a year plus $20 at the average rate of burning, but if he used his lamps twice as long he would only increase his bill by $20. There is no doubt that this is the fairest method of charging, but it can only be introduced as an alternative method.

Seeing how moderate an addition it makes to the working charges of a station to keep the machinery running at full power, the idea naturally suggests itself that the current should be stored in accumulators during the slack hours, as by this means the amount of machinery might be lessened, while it would be kept fully employed. Dr. Hopkinson laid this point before his audience, putting the battery down for $312,500, and the annual interest, amortisation, and upkeep at 20 per cent., or $62,500. On the other hand, he reduced the cost of feeder mains, coal and wages, but the net result came out practically the same as before.

Dr. Hopkinson's figures are admittedly hypothetical, but they might be very greatly varied without vitiating the results at which he arrives. To show how difficult it is to choose figures that are fairly representative we give the following table of costs contributed by Mr. R. E. B. Crompton to our contemporary *Lightning*. These include the cost of production of the current, without anything for interest, depreciation, or redemption.

	Cents per Unit.
Bradford	3.90
Newcastle	5.04
Newcastle and District	6.78
St. James and Pall Mall	7.30
Kensington	9.82
Metropolitan	10.86
House to House	11.08
Westminster	11.64
Chelsea	13.86
London Electric	23.18

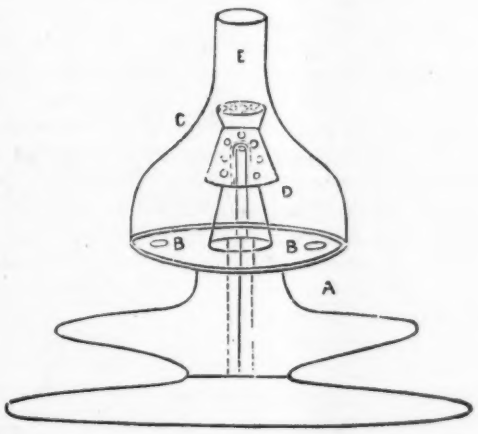
Of course the great differences here exhibited are partly fictitious. They are derived from accounts made out in some cases while the works were in progress, and when expenses were very heavy, due to the smallness of output, or to operating under circumstances of special difficulty.

Warren's Appliance for the Detection of Hydrocarbons and Other Combustible Gases when Admixed with Air.

This particular form of gas apparatus, which was brought out early this year, by Mr. N. H. Warren, is intended mainly for the detection of suspected escapes of coal gas when in confined spaces, such, for instance, as private houses, laboratories, etc. Mr. Warren, in calling attention to the device, says:

Experiments with a view of studying more closely the condensing action of platinum when in various forms of division were the chief motives which led to the construction of the same. Thus, if asbestos, for convenience sake, in the form of yarn be introduced into solution of

platinic chloride, and, after drying, ignited in a closed crucible, the substance, as is well known, has conferred upon it the property of condensing gases upon its surface, due to the impregnation of what is known as platinum black. This method of rendering asbestos sensitive is, however, attended with several inconveniences, both on account of the disengagement of acid vapors during ignition, thus rendering the texture rotten, and, at the same time, retarding the surface action by the formation of magnesium salts. To obviate these difficulties the writer has substituted for platinic chloride that of the oxalate, and by so doing has obtained a modified action of peculiar sensitiveners. This compound



is readily procured by saturating asbestos yarn, of finest quality, with a strong solution of platinic oxalate, obtained by dissolving the hydrate of that metal in oxalic acid, and, after drying, igniting the same in a porcelain crucible. If a sample of so prepared asbestos be now introduced into a mixture of hydrogen and oxygen gases, combination at once takes place, accompanied by the usual phenomenon; but if the said mixture be now substituted by one of coal gas, no action is the result. Withdraw now the sensitive wick and heat to 80° F., and replace the same in the mixture, quite a different result is at once obtainable, the wick becoming speedily raised to incandescence, and this continues as long as the faintest trace of mixed atmosphere remains. So sensitive, in fact, is the reaction that 0.5 per cent. by volume of coal gas or other hydrocarbons, when in admixture with the atmosphere, is at once readily detected.

The subjoined illustration, representing a section of the apparatus when in use, will perhaps, serve to more clearly explain the same, *A* serving at the base or reservoir of the lamp, and containing petroleum spirit which is employed as a fuel for the same, and surmounted by a gallery running round the upper part and pierced with two apertures at *B B*, intended to collect the air required, when applying the chimney *C*. In using the apparatus the wick, consisting of platinised asbestos, is first inserted in its holder and a light applied to the same. The flame caused by the combustion of the petroleum spirit may be now conveniently extinguished, leaving the uppermost portion of the wick red hot, which continues to flow whilst any petroleum spirit remains in the reservoir. While the wick is thus still flowing there is placed over it the copper thimble *D*, which is perforated with numerous small holes, and containing a further coil of platinised asbestos *E*, in close proximity.

The reaction may thus be minutely explained: The heated asbestos, fed by the petroleum spirit, naturally produces sufficient heat to maintain the second coil *E* at the required temperature of which has already been stated. If the so prepared lamp be now introduced into a room where an explosive atmosphere is prevailing, the glass chimney at once samples the atmosphere by causing an upward draught, which, passing over the heated coil, immediately raises the same to incandescence.

Objections to Firing with Lima Oil.

Some time ago the Engineers' Society of Western Pennsylvania appointed a special committee to consider the "smoke question at Pittsburgh," and their report was recently submitted. From it we take the following:

Lima oil is at present used in various kinds of furnaces, being fed into the combustion chambers by means of air under considerable pressure. It makes an easily regulated, smokeless fire, but has not received much application in Pittsburgh owing to its cost being equal to or greater than coal. Its disagreeable odor is also an objectionable feature. Electricity is proposed for heating purposes, but at present it finds little or no application here.

Every city has its peculiar needs and activities which must be recognized in attempting to apply to it general results applicable elsewhere. Of no city is this more true than of Pittsburgh, with its varied industries, its natural resources and enormous production. Hitherto smoke has been the black ensign of the ceaseless warfare carried on here with the forces and materials of nature.

It is estimated that before the introduction of natural gas Pittsburgh consumed about 10,000 tons of coal daily and that the present consumption is about 7,000 tons. In Pittsburgh and Allegheny about 25,000 houses are still supplied with natural gas, amounting to several hundreds of millions of cubic feet daily, and probably representing more than half the present coal consumption.

If, therefore, our skies are darkened now, what may we expect when the present almost smokeless natural gas fires become smoke producers? Our finest resident district, the East End, will especially suffer by the change. Already, owing to the peculiar topography of Pittsburgh, and in spite of the special smoke ordinance recently passed, the East End is often covered by clouds of smoke, mostly produced in the lower parts of the city. Of the 10,000 houses probably occupying the district, it is estimated that four-fifths use natural gas at present.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. Henry C. Rew, Vice-President of the National Gas and Water Company, Chicago, Ills., writing to the Journal, under date of November 26th, says: "I am happy to state that my apparatus for converting bituminous coal into gas by the water gas process has been put into highly successful operation by this Company at the works of the Gas Light and Coke Company, of Mattoon, Ills. * * *. The works there are hardly a 'show' plant, for the reason that the purifiers and holders are too small to allow of the running of the apparatus to its full capacity. We are now building, for our second plant (and for World's Fair exhibition), a larger plant in Cicero, adjoining Chicago, and are laying 25 miles of mains in Oak Park, Austin and Ridgeland, and this plant will be a model one in every respect. We shall soon drop the price of superb illuminating gas to $1 per 1,000, or below, at Mattoon, and intend to put the price still lower as consumption increases."

The authorities seem to be moving again in the matter of rehabilitating the gas plant at the West Point (N. Y.) Military Academy, as per the following advertisement from current newspapers: "*Proposals for Enlarging Gas Works.*—Office of the Quartermaster, U. S. Military Academy, West Point, N. Y., November 24, 1892. Sealed proposals in duplicate, subject to usual conditions accompanied by plans and specifications, will be received at this office until 12 o'clock noon, on the 24th day of December, 1892, for enlarging the Military Academy gas works, according to the general conditions to be furnished on application here. Enclose proposals in envelope marked 'Proposals for enlarging gas works,' and addressed to the undersigned, W. H. Miller, Captain and Assistant Quartermaster, U. S. Army."

While writing about this proposed improvement at West Point, which looks to be in line with good business policy, we may be excused for remarking that the gentlemen in charge of the preliminaries, provided they desired numerous responses to their advertisement from parties directly engaged in the gas works construction line, do not seem to have availed themselves of an advertising medium that appeals most forcibly to such constructors, and that reaches these more promptly than any other that was chosen by them. For instance, would it not be more in reason to have invited proposals in the columns of the American Gas Light Journal for work of the nature under consideration than in the New York *Press*, the *Times*, and so on?

Press despatches from Washington, D. C., are to the effect that on or about November 21st Justice Harlan, in the United States Supreme Court, rendered judgment in favor of the city of Hamilton, O., in a suit brought against it by the Hamilton Gas Light and Coke Company, which Company was regularly incorporated on private account for the purposes of manufacturing and distributing gas in the city, the latter, however, reserving the right to adjust, from time to time, the price that should be charged. Subsequently the city elected to and did build a works to be operated on municipal account, the undertaking being made under a general act of the Legislature. The old Hamilton Company protested, claiming that the city's act was an impairment of the con-

tract between the city and the Company. The Supreme Court, however, rules otherwise, holding that the city was under no obligation to take gas from the Hamilton Company.

THE new plant of the Belleville (Ills.) Gas Company is virtually completed. The trial test is said to have been perfectly satisfactory.

MR. DANIEL CURRIE has been reappointed Superintendent of the works of the Columbia (Mo.) Gas Light and Coke Company.

THE Chicago (Ills.) Gas Fitting and Supply Company has been incorporated by Messrs. J. E. Graves, S. H. King, Jr., and T. R. Chapin. Capital, $10,000.

A PENNSYLVANIA correspondent, writing to the JOURNAL under date of Nov. 26, says: "Among recent transactions in Pennsylvania gas shares, I note the sale of a block of stock in the United Light Company, of Uniontown, Pa., the transfer having been effected at par. The total value of the deal amounted to $8,000. I am told that part of this same lot was bought one year ago at $75 per share; or about the time that Mr. J. F. Seamon took charge as General Manager of the Company. As the Company is now free from debt, and as a dividend will be declared in January, it is hardly necessary to say that there is no stock now on the market, at par or even well above that figure. The outlook for business is splendid, and the plant is in excellent shape, thanks to the united and well-directed control of Messrs. Ewing, Howell and Seamon."

THE following racy sketch is from the pen of "A Harvard Student," who seems to have had to do with a "kicking" somewhat different from that enjoyed by the members of his 'Varsity football team—for this particular student comes in contact with the kicking gas consumer. To put it in another way, the student seems to have been the ball instead of being a "rusher." This is what he has to say: "To nearly everyone is the meter reader familiar. He is the stoical individual who, armed with a book and lantern, monthly or quarterly invades one's premises, goes to the meter, glances at it in a careless kind of way, writes something in a book, and departs, answering all questions addressed to him as to last month's bills, or to the prospective bills for the next quarter, as short as he possibly can. Apparently heedless of complaints and careless as to whether the gas is giving satisfaction or not, heedless even of offers of bribes, sometimes thinly veiled or made out and out. Who is this being who comes and goes so stolidly? Few know, and few think it worth their while to try to find out. The reading of the meters is necessary in order that the amount of gas consumed may be ascertained, and the monthly or quarterly bill sent out on its basis. About five days at the end of the month are devoted to this work. Now, as it is evident that it is a waste of money to keep men paid during the whole month, when they only have to work for a few days at the end, the scheme was adopted of employing persons for these five days only. The only ones who seemed to supply the necessary conditions of trustworthiness, intelligence and ability to give only a part of their time to this work were students. So the practice grew up, first, I believe, in Chicago, and a year ago last fall here (Boston), of employing needy college students for this work. The pay of the students was first regulated by a day's work, or so much an hour. This scheme did not prove to be very successful, as many students had to attend classes, and it was very difficult to estimate how long they worked. Hence the practice of paying for the amount of work done was substituted, and they are now paid at the rate of a cent a meter. As may be imagined, the number of students employed is very large. They represent many different schools and colleges, of which are Harvard College, Harvard Medical School, Tufts College, and the School of Technology. The difficulties encountered by the meter reader are numerous and annoying. Apart from the human difficulties, in the shape of complaining men and women, is the difficulty of access to the meters. This difficulty varies in different routes. In the modern districts, such as Back Bay, little or no trouble is encountered, but in parts of the city where the buildings have been built over or subdivided, the trouble of getting at the meter is often very great; so, too, in many places where one has to descend a trapdoor into a dirty cellar, with the cobwebs hanging in festoons from the low ceiling. I remember one time, when emerging from such a place, that I was greeted with the following remark from a street gamin: 'Say, Mister! Your back is covered wth cobwebs.' On another occasion I was taking a new route on Hanover street. The book said that the meter I wanted was situated on the top floor of a certain number. It so happened that there were two doors with that number, side by side, one being distinguished by the letter A from the other. As it was dark I did not notice the difference. Now, the meter I wanted belonged to a small clothing establishment at the top of the house, so I opened the door and walked right straight upstairs. The dusk prevented my seeing that I was in a private house. When I got to the top I hunted around in vain for the meter. I then proceeded to descend. Just as I reached the bottom of the first flight of stairs I was confronted by a man with a revolver, which he pointed at me, commanding me not to move, if I did not wish to die. He had mistaken me for a burglar, and it took me some time to persuade my captor of my innocent vocation. At another time I was making my way over a lot of empty boxes and barrels in the cellar of a meat shop on Washington street. I stepped on an apparently solid piece of board, which suddenly gave way, plunging my whole leg into a barrel of brine that had been there for two years. The odor was horrible, and I had to immediately buy another pair of trousers. The different races of people I have met in my employment as meter reader have afforded me much interesting study. As I could speak a little French and German I found that I easily ingratiated myself with the people of these nationalities. I learned a little Italian, and I found that by saying 'Buon giorno, signor; dovay il gazo?' (Good morning, sir; where is the gas meter?) I would meet with a quick response, and a ready willingness to show me the place. This readiness was really very helpful, for the foreigners are usually very suspicious, and are often quite surly and disobliging if spoken to roughly. I have often tried to muster enough Chinese to make my request known in that language, but have always failed. One gets a wonderful insight into the inside working of the great productive machine of our civilization. Through factories teeming with workmen and workgirls, in sweating shops, and often into even worse places the gasman goes, not heeding the frequent sign of 'No admittance.' It is interesting to hear ministers, with many adjectives, talk about slums, but if they could only accompany the gasman in his rounds they might see something of life and have so much to tell that they would find the use of adjectives unnecessary. Thus I have been in opium joints, gambling hells and places which cannot be named. My badge has carried me into the most secret and curious places in Boston, and it were long to tell and hard to trace all the curious, interesting and instructive experiences I have been through as a meter reader in the Boston Gas Light Company."

AN odd cause (although seemingly one that had reason for its ordering) for a strike among workmen is reported from Haverhill, Mass. At one of the large manufactories of carriages there the proprietors, owing to pressing orders on their books, directed that the blacksmiths, for a certain period, be obliged to work during 10 hours of each day—the blacksmiths' work by the piece. As 10 hours' work at this season of the year means labor during a part of the day when ordinary daylight is insufficient or lacking, the proprietors also decreed that each smith should pay 25 cents per week towards payment for the gas lights needed to enable him to keep up with his duties. Naturally the men objected and the employers having refused to recede from their demand a strike was ordered. The proprietors, to say the least, were inconsistent in their ruling, for the gas lights in the other portions of the shops, which are as necessary to the workmen in performing their tasks as are the lights for the smiths, are paid for in the usual way by the factory owners.

THE Auer Incandescent Light Company, of Montreal. which was incorporated last October, has for its President M. Desjardins, a member of the upper branch of the Provincial Legislature.

THE Derby Gas Company, of Birmingham, Conn., took possession of its new offices, in the handsome building on Elizabeth street, the day after Thanksgiving. Manager Nettleton will be glad to welcome the gas men who visit his district, and he can without doubt show them over a beautifully appointed general office and snuggery.

ABOUT a fortnight ago Captain Lusk, of the local government of Washington, D. C., forwarded to Mr. Ford, inspector of gas and meters, a number of complaints respecting what the complainants termed the "general unsatisfactory quality of gas supplied, not only to the street lamps, but to ordinary consumers as well." Some days after the receipt of the communications, Inspector Ford made the following reply: "I have the honor, in reply, to say that at this season of the year the supply of gas is frequently interrupted and rendered unsatisfactory, owing to the presence of naphthaline in the service pipes and meters. This is a fruitful source of complaint at times, amounting to over 100 a day, all asking for light. This trouble applies to street lamps as well as private

consumers. Aside from the trouble mentioned by the presence of hydrocarbon naphthaline in the pipes and meters, the gas in the northwestern section of the city has been poor on several occasions lately. I am told that the depression of the illuminating power on Tuesday afternoon, November 15, which was observed in that section of the city, was due to manufacturing gas for the first time in a new water gas plant that has been erected at the Washington Gas Light Company's works, foot of 26th and G streets. I may say in this connection that it is almost an impossibility under such circumstances to prevent the admission of air. I think when this new apparatus is in good working order the supply of gas in the northwestern section of the city will be much more satisfactory. The gas we receive at the laboratory, corner 10th and D streets, northwest, appears by photometric tests to be of high photogenic power, and should give a satisfactory light, barring stoppages in the service pipes and meters, which are purely and entirely local defects, that, with the knowledge possessed at the present time by gas engineers, cannot be prevented, owing to sudden and decided changes of temperature."

THE proprietors of the Gardner (Mass.) Gas Company are building an addition to the Logan street works.

AT the annual meeting of the Baker City (Oregon) Gas and Electric Light Company, which was held on Monday last, Mr. J. H. Parker was re-elected President.

THE new 600-horse power engine for the Newton and Watertown (Mass.) Gas and Electric Company has been placed in position.

THE failure of the Universal Gas Construction Company, of Chicago, is announced. It did not amount to much. The President of the concern was J. M. Barrett, and its offices were at 94 La Salle street.

ABOUT as serviceable a gasholder as there is on Long Island, outside of those operated by the great Brooklyn Companies, of course, is the double-lift, in steel tank, on the ground of the East New York branch of the Citizens Gas Light Company, of Brooklyn. This branch, by-the-way, is putting out great quantities of gas these dark days.

THE following from the Detroit *Tribune*, of November 24th, explains itself: "Senator James McMillan and William McMillan, his son, have purchased the Mutual Gas Company, of Detroit, entire, of Commodore Thompson Dean, at a figure close upon the $1,500,000 mark. The Company will in all probability soon be amalgamated with the Detroit Gas Light Company and the Michigan (natural) Gas Compay. The sale was made in New York city a few days after election. Jas. R. Hopper, of Detroit, represented Commodore Dean, and William C. McMillan the Senator, his father. The negotiations had been pending for several weeks. The deal marks an epoch, an incoming era of cheap gas. Senator McMillan, who is a large stockholder in the Michigan Gas Company, said yesterday he believed it a good thing to buy the Mutual Gas Company, with its large plant for the manufacture of artificial gas, in order to protect the patrons of the Michigan Gas Company from all possible inconvenience should its supply of natural gas run short. 'The opportunity for purchase was a good one,' he said; 'one which might not occur again if allowed to pass, and advantage was taken of it. William C. McMillan conducted all the negotiations.' 'What about the rumored amalgamation of all three of the Gas Companies?' 'Nothing has been done toward a combination yet. I believe that is all I have to say.' James R. Hopper, Commodore Dean's agent, declined to discuss the deal. 'I am not in a position to talk,' were his words. 'I have no interest in the Mutual Gas Company, and object to talking about other people's affairs. Senator McMillan is in the city, and accessible, I believe. You had better see him.' He neither affirmed nor denied the sale. The deal is the first successful step by the great Standard Oil Company to get control of the Detroit district. The Michigan Gas Company, in which Senator McMillan is so largely interested, is fed by the natural gas wells of the Standard Oil Company. It has long been known as one of the Standard Company's interests. With the natural gas pressure at Toledo and Pittsburgh decreasing, and in the light of the bitter experience of the natural gas supply at other important points, the question of how much longer the Ohio gas fields might be relied upon to supply Detroit was most perplexing to the Standard Company. With the Michigan, the Mutual and Detroit Companies amalgamated, their mains under one control, the customers of the Michigan Company could be supplied with artificial gas from the Detroit and the Mutual Companies for heating purposes. An ironclad contract exists between the Detroit and Mutual Companies, by which the Mutual has the exclusive right to furnish artificial gas west of Woodward avenue. Under this contract the Michigan Company, though now owning the Mutual Company, cannot supply artificial gas through its mains to any point west of Woodward avenue. Hence the 'combine' is only half completed and the Michigan Company's patrons only half protected. The Mutual Company's perpetual franchise made the property more desirable than the Detroit Company's, as the latter has no franchise, so far as the records show. The intention is eventually to join the Detroit Company under the Mutual's perpetual franchise, whereupon the amalgamation will be completed. Senator McMillan's offer for the Mutual Company was accepted September 30th. The amount of capital involved in the ultimate amalgamation will be enormous. The Michigan Gas Company has a capital stock of $2,500,000 and is bonded for $2,200,000. The Mutual was purchased for $1,500,000 and the Detroit Company is capitalized at $1,000,000. This shows a $7,500,000 investment. Learning how necessary it was for the Standard Company to have both artificial Gas Companies, Eastern speculators bid for the Mutual. It looked as though they would get it, but Senator McMillan asked Mr. Hopper to prepare a statement of the Mutual Gas Company's condition. This was done. It appeared that the Company's net earnings were never less than 8 per cent. per annum during recent years, and that loss by leakage was not more than 4 per cent. These figures were verified, the Senator was satisfied, the deal was made, and the Eastern capitalists were frozen out. Senator McMillan will hold the Mutual Company's franchise until the time when amalgamation with the Detroit Company can be made on a sound basis."

The above furnishes another example of the ultimate and inevitable results of the free granting of gas charters. It has been long an open secret that there was no money in the supply of natural gas, as followed at Detroit by the controllers of the Michigan Gas Company, and the proprietors of the latter, naturally tiring of putting their hands in their pockets, were in self-defence obliged to secure something tangible—something that would put them in the way of filling their pockets. The old Companies did not want to buy the Michigan folks out—the latter, in fact, had nothing much to sell—so they had to turn purchasers, and pay for that which they bought. On the whole the consolidation will be a good thing for all concerned, even including the gas consumers, who will be assured of an even and continuous service. No doubt the framework for the complete amalgamation of the three Companies has been laid out, and when it comes to pass we hope that Mr. Isaac C. Baxter will be in control of the consolidated engineering department. Taking the Detroit *Tribune's* account as entirely accurate, we must compliment the staff of the old Mutual Company on the rigidness of the supervision that enabled it to keep its leakage account down to 4 per cent., which figure approaches closely to that of Mr. Nettleton, at Birmingham, Conn., who now holds the record in that respect. If the *Tribune*, however, made an error in reporting the return, the Mutual Company could still be fairly congratulated, even if the figure 8 were substituted for the 4.

IT is reported that the proprietors of the Askins process of gas making have applied for a franchise for the establishment of a gas works at Deadwood, South Dakota. They agree to supply illuminating gas at 80 cents per 1,000, and fuel gas for 35 cents—pretty low rates these seem to the residents of an effete East. Deadwood is the center and capital of Lawrence county, So. Dakota, is in the Black Hills mining district, and has a population of about 8,000. It is midway of Yankton and Cheyenne.

MR. JOHN J. CLAHAN, who has been elected to the next Assembly from the 1st district of Erie county, N. Y., is a foreman in the works of the Buffalo Gas Light Company.

ABOUT a fortnight ago the toilers in the business district of Toronto, Canada, who depended on the Toronto Incandescent Electric Light Company for the supply of artificial illumination were brought to a realizing sense of the fickleness of that agent. The interruption was annoying, in that it happened at the busiest hour (about 4:30 P.M.) of a very dark afternoon, but those who maintained their gas connections were speedily in line again with the duties of the hour. It was different with those who depended solely on the current, for these had to resort to lamps and candles, and amongst the total believers in the light of some day was found the Toronto *Globe*. They had to get out their paper by the dim religious light of candles; but they got it out just the same.

THE American Meter Company will construct a station meter for the Mutual Gas Company, of this city.

THE Electric Light Company, of Pioche, Nevada, has gone out of business.

The Market for Gas Securities.

In line with its usual good policy, the Consolidated Company refused to increase the dividend rate, which was made last week at 1½ per cent. for the quarter. The shares, which are now quoted ex dividend, opened to-day (Friday) at 125¾ bid, thus showing the great strength of the Company's position. There might be something in the rumor that a quasi-understanding exists between the manipulators of the East River franchise and the inner circle of the Irving place headquarters, but whether so or not, Consolidated stock, keeping in mind the enormous value of its holdings in city real estate, is worth to-day at least 150. Standard, common and preferred, is in good demand and both classes look to us to be purchases. The common is bid for at 35, and the preferred is in hot demand at 89. Other city shares are firm. The affairs of the Metropolitan branch of the Consolidated Company were completely closed up recently, and a very pleasing finality to the same was afforded in the testimonial awarded by the Metropolitan Board of Directors to their former guiding spirit, Mr. Oscar Zollikoffer, whose name will be remembered for all gas time in connection with his work in placing the Metropolitan Company where it was prior to its merging with the Consolidated Company.

The event of the week in Brooklyn gas matters was the promulgation of Judge Osborne's decision ruling out the demurrer of the Equity Gas Company to the proceedings nominally instituted against it by the State, but virtually brought in the interest of and sustained by another corporation, which, sooner or later, is *certain* to feel the weight of the Equity Company's appearance in the field as a supplier of gas. The public prints seem to have tried to make it appear that the decision referred to put the Equity Company's charter in peril, but this is not so, for the integrity of that charter has the seal of the Court of Appeals upon it. The injunction which also accompanied the overruling of the demurrer simply restrains the Company from extending its system of main pipes for the present, and as we look at it the Company could to-day manufacture gas and distribute the same through the pipes that are laid, without let or hindrance. No wonder the "other corporation" fights hard, but it is pretty near the last ditch. On the other hand, the Equity Company is anxious to keep in the swim; for, with its modern works, and in view of the near approach of consolidation of the gas interests of Brooklyn, its managers know full well that terms will have to be made with them. In the meantime the Boston crowd are skirmishing for capital, and the real meat of the situation this week is their appeal to a new Moses to lead them out of the wilderness. Our readers may take it for granted, just as we said several times last summer, that Mr. Addicks would find Brooklyn a rather queer place to work in, when he came to find his way inside. All classes of Brooklyn stocks are strong and higher.

Chicago gas developed unlooked for weakness, the opening bid price to day being 92¾; it was offered at 93. Baltimore Consolidated is weaker, on a movement by the residents to appeal to the Legislature for a cut in the rate to $1 per 1,000. Despite the howling, Baltimore Consolidated is a purchase at anything under 60. Mr. Smalley, who for so many years controlled and directed the fortunes of the Citizens Gas Company, of Newark, N. J., has retired from the Presidency. Failing health alone impelled him to retire, and we sincerely hope that relief from business cares will bring him speedily around. His successor is Mr. John L. Blake, of Orange. Lacledes are weaker. We note the following sales at auction: 5, Buffalo Mutual, at 125; 3, Metropolitan, Brooklyn, at 118¾; 240, Peoples, of Brooklyn, at 96½; 40, Williamsburgh, at 140¾; $1,000, 6 per cent. mortgage, Metropolitan, New York City, at 110 and accrued interest.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

December 5.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	125¾	126x
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	165	170
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	142	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	35	40
Preferred	5,000,000	100	89	91
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	132	135
Citizens	1,200,000	20	113¼	113¾
" S. F. Bonds	320,000	1000	—	103
Equity Gas Light Co	2,000,000	100	37	—
Bonds	1,000,000	—	—	85
Fulton Municipal	3,000,000	100	132	135
" Bonds	300,000		102	—
Peoples	1,000,000	10	95	97
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	117	120
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	150	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	140	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	88½	88¾
2d " " "	3,000,000	1000	77½	78
Bay State Gas Co.—				
Stock	5,000,000	50	60¾	61¾
Income Bonds	2,000,000	1000	77	78
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	92¾	93
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	85	90½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	105	—
2d "	2,500,000	1000	104	105
Consumers Gas Light Co., Jersey City	2,000,000	100	20	—
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	190	191
Central, S. F., Cal			90	—
Capital, Sacramento, Cal			55	—
Consolidated, Balt.	11,000,000	100	57½	58
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn	750,000	25	120	128

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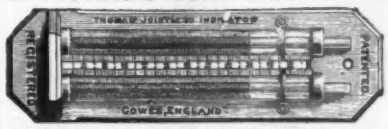

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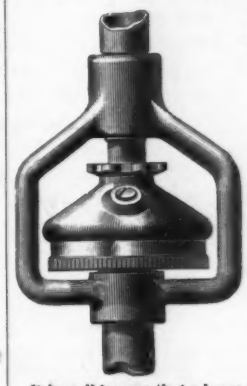

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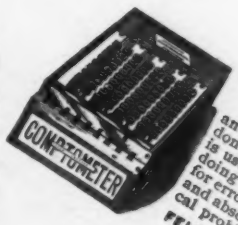

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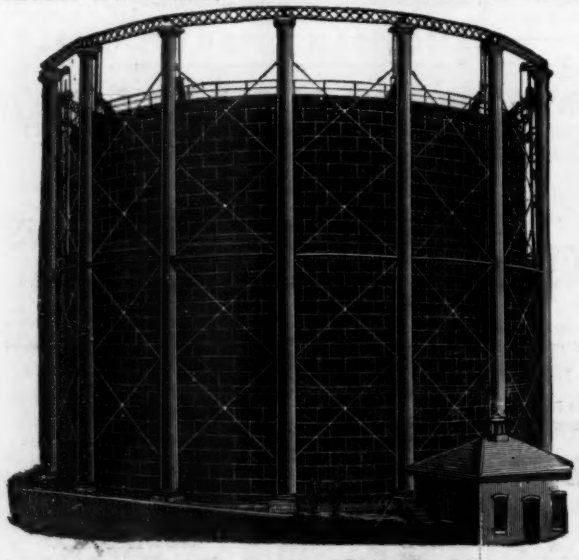

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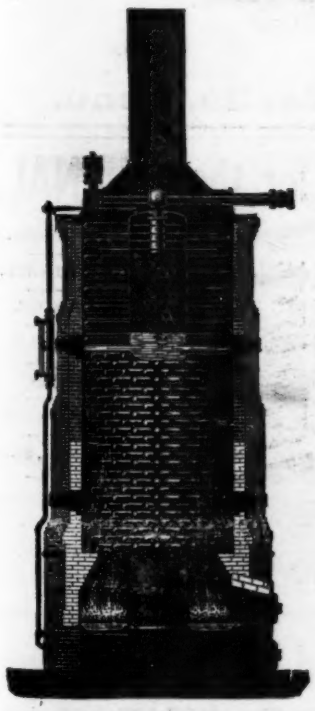

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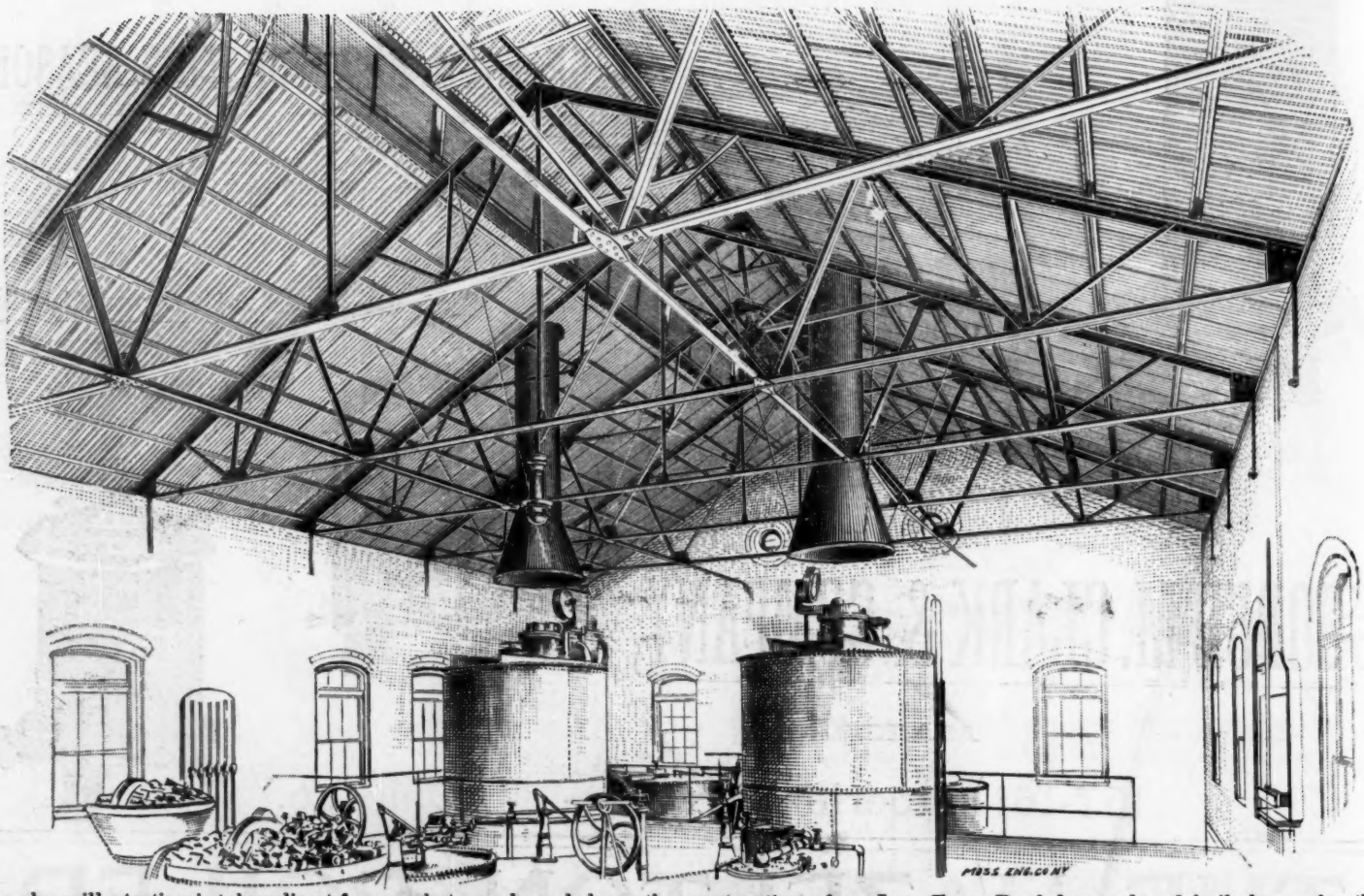

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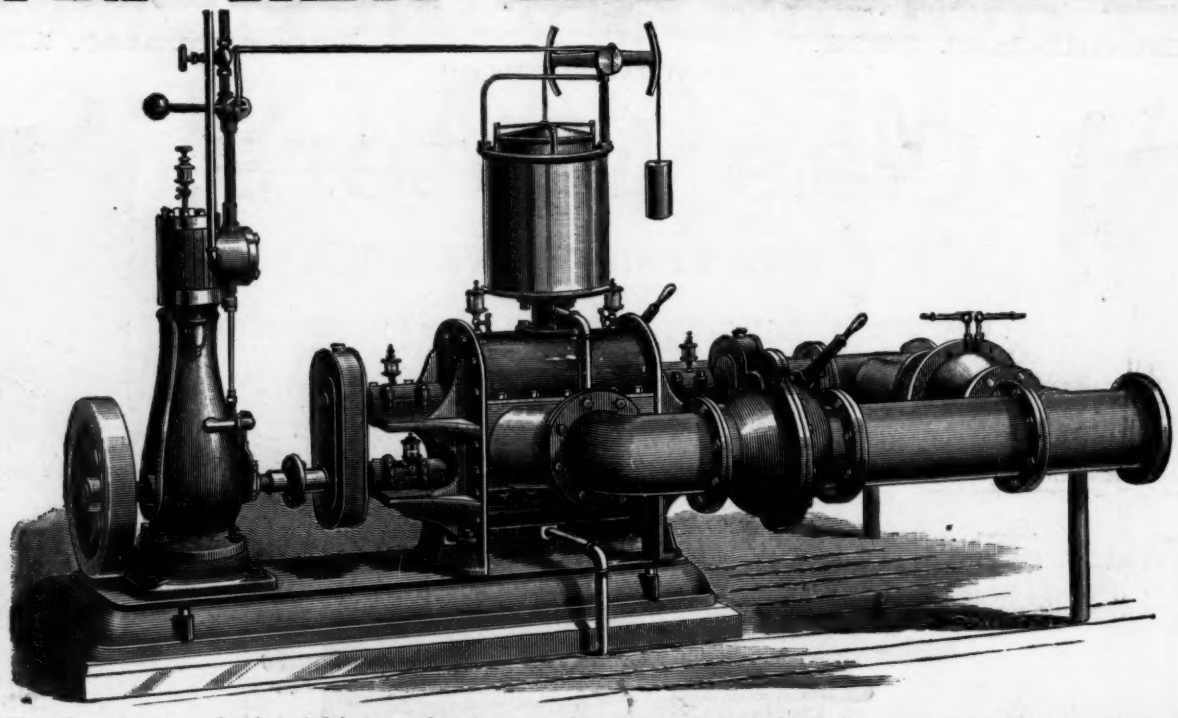

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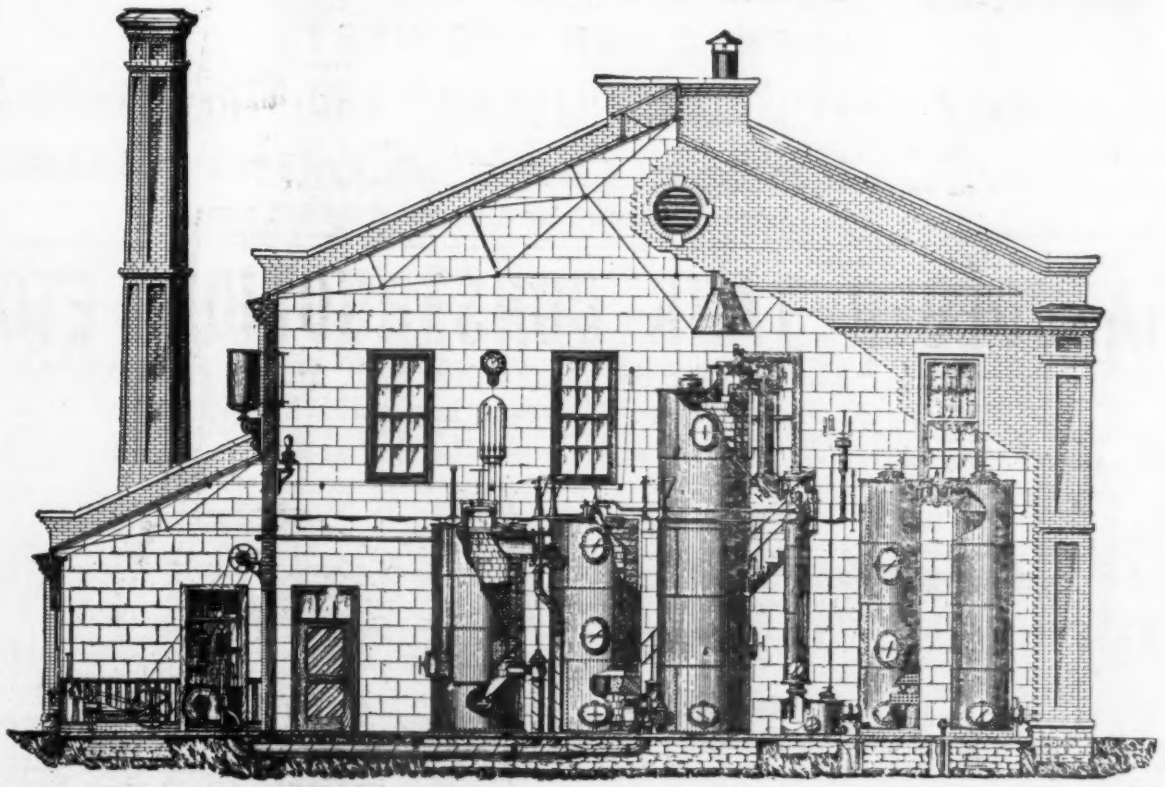

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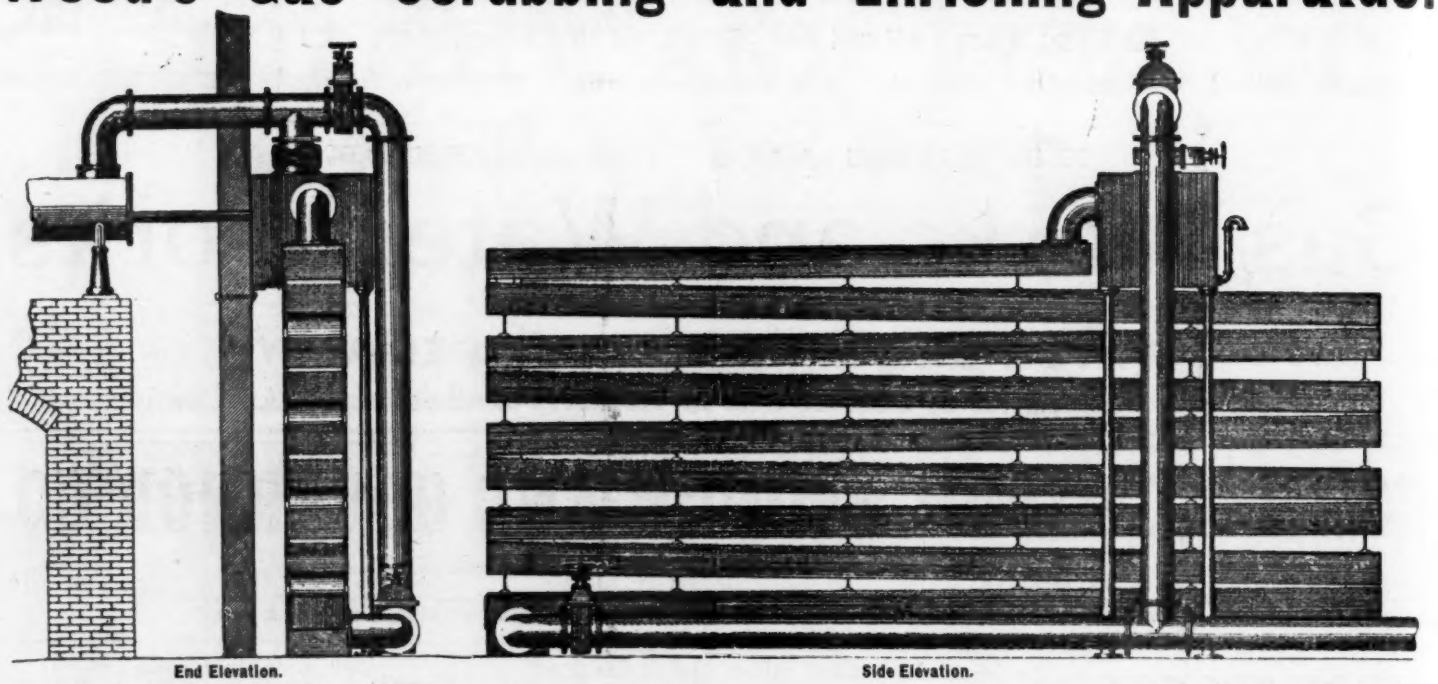

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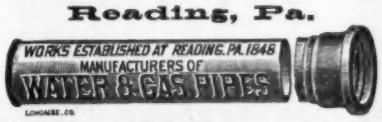

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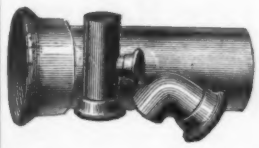

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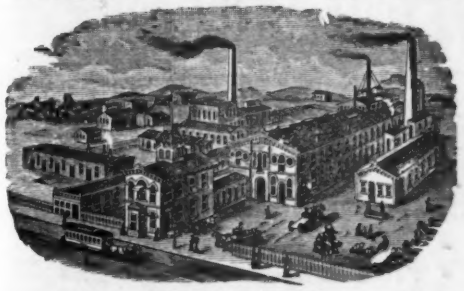

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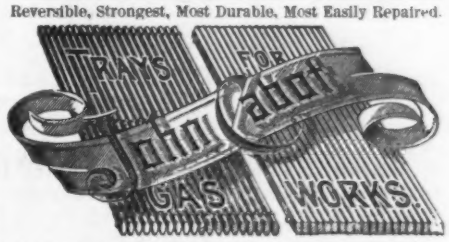

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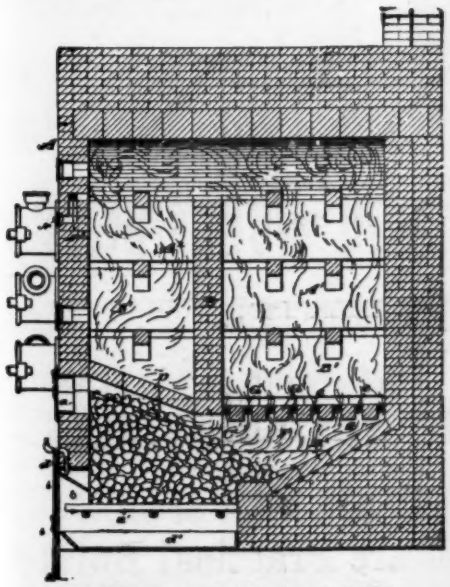

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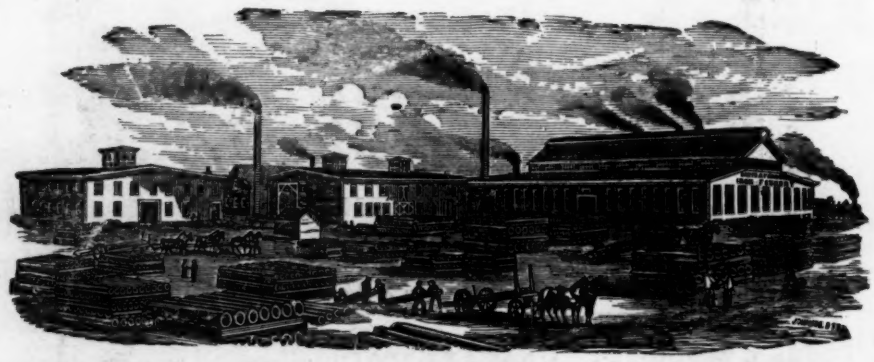

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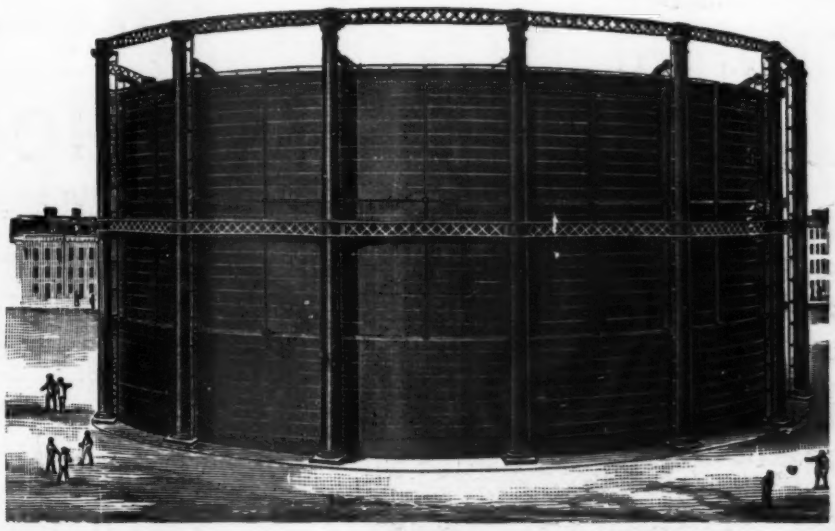

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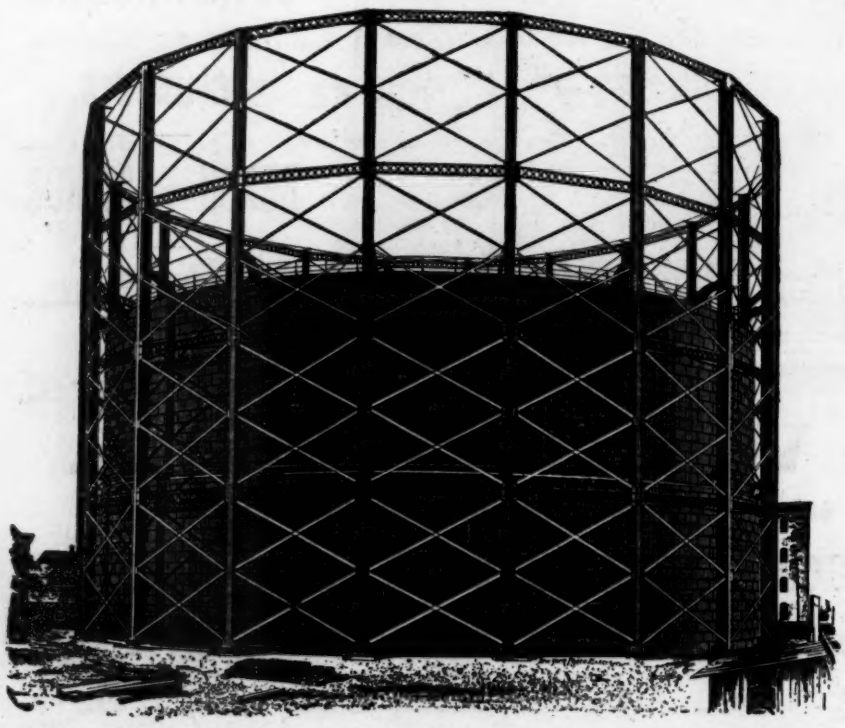

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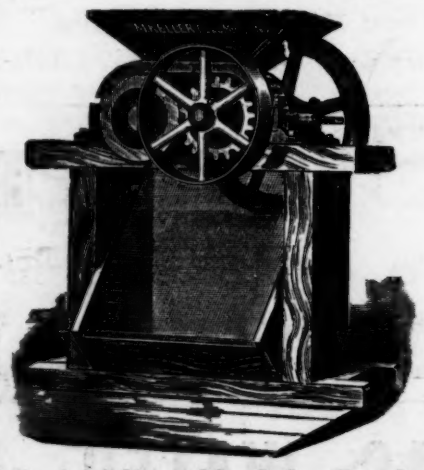

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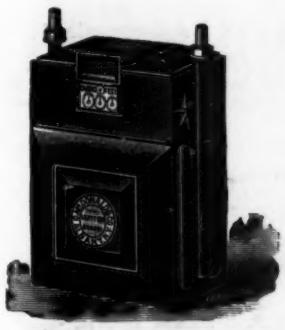

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The superior feature of this meter is that it avoids the danger of displacement of the valves, and consequent loss of gas, either in shipping, handling, or by dishonest consumers.

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IN A GREAT VARIETY OF STYLES AND SIZES.

Gas Cooking Stove No. 7 C.

The Most Economical, Efficient, and Durable Gas Stove Made.

SIZE.

Stove.	*Oven.*	*Broiler.*	*Top.*
31 inches high,	9⅛ inches high.	10 inches high.	21 inches high.
17 inches wide.	15 inches wide.	15 inches wide.	16 inches wide.
	12¼ inches deep.	12¼ inches deep.	
	Length over extension shelves, 32 inches.		

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1½ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1½ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

Catalogue showing Styles and Prices sent free on application.

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Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc.

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Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.

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